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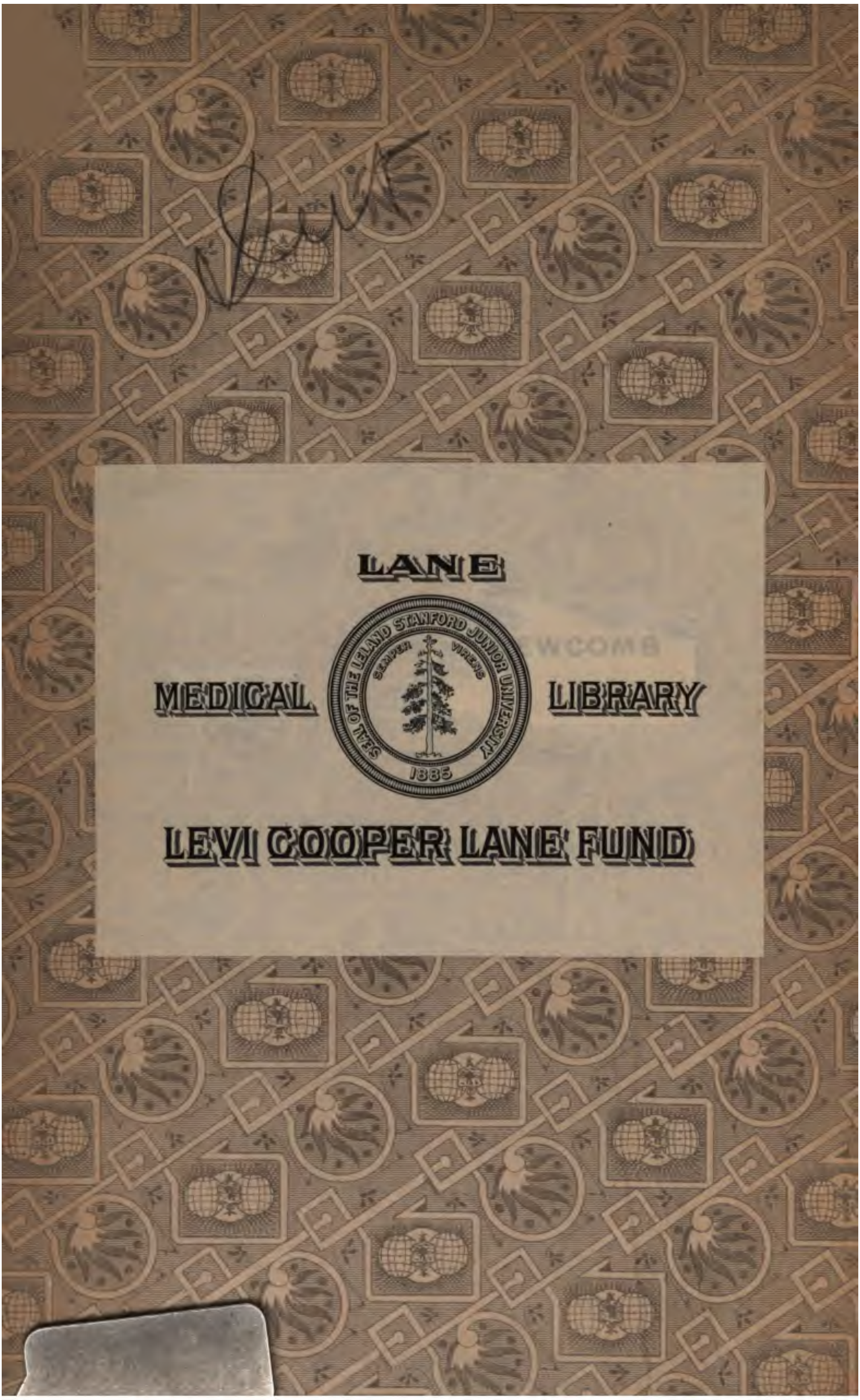

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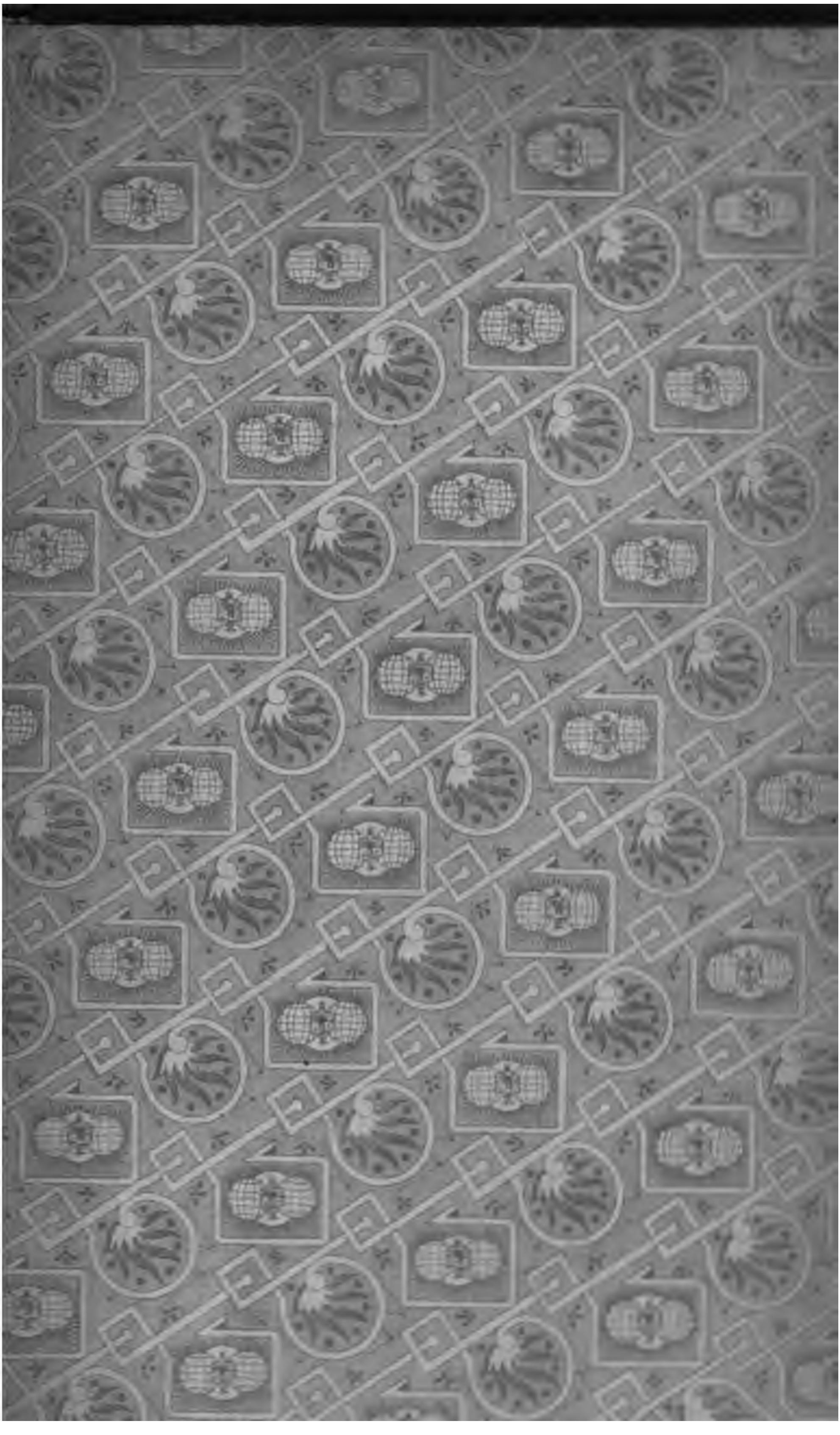

AGE OF THE DOMESTIC ANIMALS

BEING A COMPLETE TREATISE ON THE

DENTITION OF THE HORSE, OX, SHEEP, HOG, AND DOG,

AND ON THE VARIOUS OTHER MEANS OF DETERMINING THE AGE OF THESE ANIMALS.

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BY

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H89
1891

TO THE MEMORY OF

ARMAND GOUBAUX,

LATE DIRECTOR OF THE VETERINARY
SCHOOL AT ALFORT,

AND TO

GUSTAVE BARRIER,

PROFESSOR OF ANATOMY AND EXTERIOR AT THE VETERINARY
SCHOOL AT ALFORT,

THIS WORK IS RESPECTFULLY DEDICATED,

IN RECOGNITION OF THEIR SCIENTIFIC TEACHINGS, FROM WHICH
I HAVE LARGELY PROFITED AND DRAWN, AND IN SINCERE
APPRECIATION OF THE MANY COURTESIES I
RECEIVED FROM THEM WHEN A
STUDENT AT ALFORT.

THE AUTHOR.

PREFACE.

As an owner of horses and dogs, and later as a student, practitioner, and teacher of veterinary medicine, the author has constantly regretted the poverty of practical books on the domestic animals, and has felt the want of accurate text-books on many of the ordinary subjects concerning them. Upon the age of the domestic animals there exist in English but incomplete and scattered writings; the best of them by writers of the first half of the century, which have only been supplemented in later years by short compends, or the publication of charts of variable merit, with but a small amount of descriptive matter.

The author has attempted to prepare such a book as he feels would have been of interest and service to himself in his association with animals as a layman, and would have aided his studies and appreciation of the anatomy of the teeth, dentition, and the means of determining the age. He hopes, also, that this work will furnish, to students and veterinarians, knowledge which will aid in surgical operations on the mouth.

In French, German, and Italian the literature upon this subject is much more complete, and the articles in these languages are much better illustrated; so that the author has drawn freely in quotations and translations from the list of writers found in the appended Bibliography, and has used many illustrations where he has not believed that new drawings would be an improvement upon the older ones. He wishes to recognize especially his indebtedness for many paragraphs which have been freely translated, and for a majority of the illustrations on the horse's age, from Goubaux and Barrier; for illustrations on the dog, from Girard; to text and the use of illustrations on the hog, from Dr. Olof Schwartzkopff; and the use of illustrations on the human mouth, from the White Dental Manufacturing Company, of Philadelphia.

RUSH S. HUIDEKOPER.

BROADWAY, COR. FIFTY-THIRD STREET,
NEW YORK, October, 1891.

D. It becomes triangular and has three (3) borders, one anterior and two lateral. The summit of the triangle looks backward. (Sections 8 to 11.)

E. Finally the table surface is flattened from side to side. (Sections 12 to 16.) This last form characterizes very old age, and lasts for the life of the animal.

Girard designated this form of the tooth as biangular. Distinctive shape in the dental table is much more regular, and gives a more reliable source of judging the age in the pincher teeth than in the intermediate, and more so in the latter than in the corner teeth. The same is true of the incisors of the upper jaw, but it is rare that we examine the table of these as an aid in judging age, except in old animals from sixteen years to twenty and over.

STRUCTURE OF THE INCISORS.

The study of the structure of the incisors of permanent dentition furnishes valuable indications for determining the age of the horse. This study is an indispensable adjunct for the complete appreciation of the descriptions which have preceded, and will allow us to understand better the peculiarities of form which we find on the table of the tooth in its changes from year to year.

If we take as a type an inferior incisor at the moment of its first appearance in the body of the jaw-bone, we find that it commences as a germ, which consists of a sack (germ-follicle) into the interior of which protrude two papillæ,—one superior, *a*, and one inferior, *b* (Fig. 11), which look toward each other.

The first, *the germ of the enamel* (*a*), is of a conical form, and is placed in what will become the dental cup.

The second, *the germ of the ivory* (*b*), depressed from in front to behind, fills the cavity which hollows out the root of the tooth.

The surface of the first is destined to the formation of the enamel of the tooth, which function it completes by the time the tooth has appeared through the gum, when the papilla disappears.

The other, which forms the ivory or dentine, remains until a more or less advanced period of the life of the animal, and furnishes the tooth with its vitality.

In the interspace between these two papillary systems is deposited the matter which constitutes the bulk of the tooth (Fig. 11, *d*). This at first consists of a very thin, conical plate hollowed out on the inside, and containing a deep depression on its free extremity. Later, the walls of the dental follicle (Fig. 11, *c*) are transformed into the alveolar periosteum. If we refer now from Fig. 11, where we find *a*, the papilla of the enamel; *b*, the papilla of the ivory; *d*, the plate consisting of the deposits of these two papillæ,—that is, the enamel and dentine juxtaposited,—and *c*, the germ sac, which is to become the alveolar periosteum, to Fig. 12, which is a longitudinal antero-posterior section of an inferior permanent pincher tooth, fully developed (somewhat enlarged), we find *E*, the enamel of the cup, surrounding this cavity, from which the papilla has entirely disappeared; *P*, the cavity of the ivory papilla very much diminished in size; *I*, the dentine occupying the major portion of the tooth, having developed on the inner surface of the thin plate which we found in Fig. 11. In Fig. 12, at *T*, which represents the table of the tooth after the borders have been worn, we find a separation of the enamel of the cup and the ivory enamel (Fig. 12, *E E*), which we find continuous in Fig. 11, *d d*.

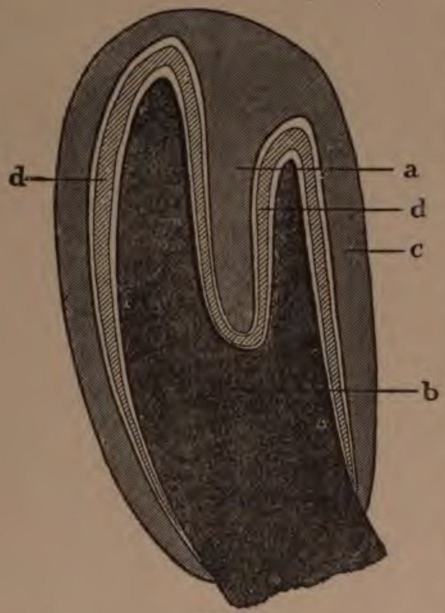


FIG. 11.

Schematic section of the dental follicle of an inferior incisor in the horse. a, superior papilla,—germ of the enamel; b, inferior papilla,—dental pulp or germ of the ivory; c, wall of the follicle; d, plate of enamel and dentine juxtaposited.

Three substances enter into the structure of the teeth, — one fundamental, the dentine or the ivory, and two covering substances, which differ from each other very much, and are known as the cement and the enamel.

1. THE CEMENT (Fig. 12, *C C*).—The cement forms the most superficial layer; it is deposited directly upon the enamel over the whole surface of the tooth, and dips into the cup, which it fills more or less completely in different subjects. Sometimes it is excessively thin, 2 to 3 mm.; at other times it is from 10 to 15 or even 20 mm. in thickness. It is generally thicker in the lower teeth than in the superior. MM. Chauveau and Arloing, in France, and Mr. Mayhew, in England, were the first to call attention to the importance of this in judging age.

It will be readily seen that the size of the cavity in the dental cup depends greatly upon the amount of the cement which is deposited in it. It is

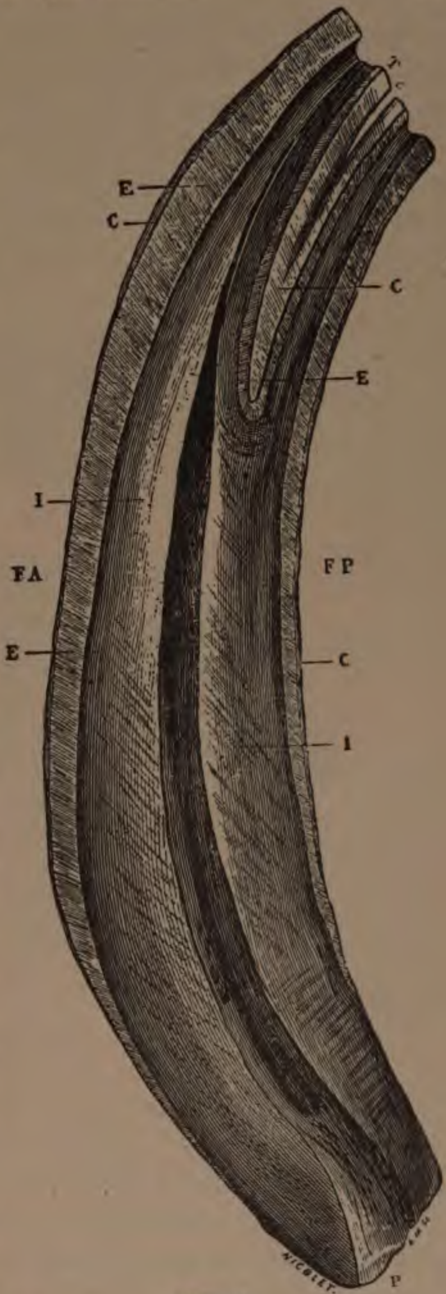


FIG. 12.

Longitudinal and antero-posterior section of permanent incisor (enlarged). F A, anterior, F P, posterior face; C, cement; E, enamel; I, ivory, or dentine; T c, external dental cavity, or cup of enamel lined with cement; P, internal dental or pulp cavity.

exceedingly rare to find excess of depth due to increased depth of the enamel, which condition will, however, be considered in the study of the abnormalities of the teeth.

The cement is a protecting layer which offers only a moderate resistance to the friction of food and other substances, and disappears at an early date from the periphery of the tooth, while it persists in the cup of the tooth so long as the latter remains on the table, where it forms a whitish spot, surrounded by a band of enamel. (Fig. 10, *A*, *B*, and *C*.) The cement is shown by microscopical examination to be a bony formation, secreted by the alveolar periosteum (germ sack), and is not a transformed ivory or dentine as given by Simonds.

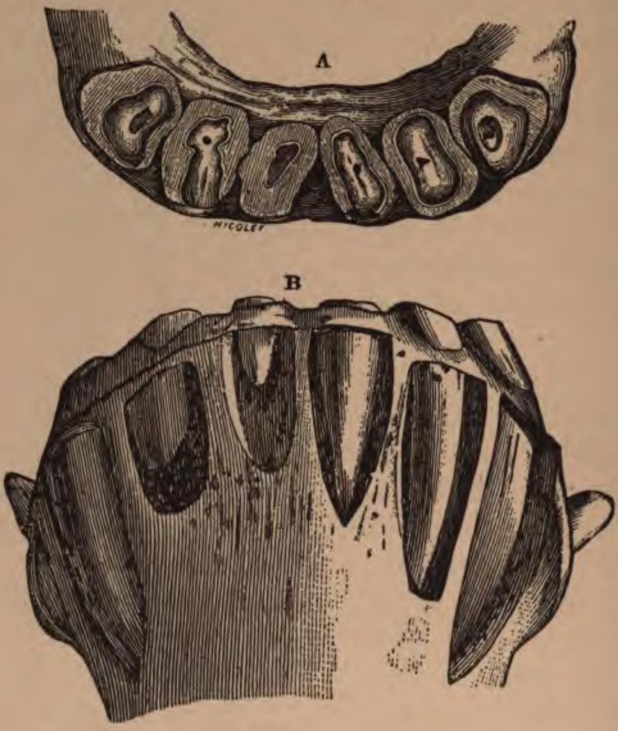


FIG. 13.

Cementation of the roots of the incisors. A, dental tables; B, roots in their alveolar cavities.

It is found in greatest quantity at the crown or free extremity of the tooth; but in very old horses, when the teeth have worn down to the roots, and the dentine, no longer protected by the enamel, offers a diminished resistance to the friction to which they are exposed, the irritation of the dormant periosteum sets up a new secretion, and cement is thrown out often in very great quantities to strengthen weak roots. As the inferior incisors are the shortest, and the first to wear away, we more frequently find the large masses of cement in the lower jaw. We again find excessive deposits of cement around the roots of the teeth when they have been loosened or irritated in their cavities by the rough pressure of bits, or have been injured by any accidental cause. This occurs most frequently in vicious or playful horses which have the habit of biting roughly at foreign bodies. We see in this a wise provision of nature to succor these important organs after accident, and from the effects of old age.

2. THE ENAMEL (Fig. 12, *EE;* Fig. 11, outer surface of *d*). —The enamel is the true protecting layer of the teeth. Underneath the cement it forms a sort of armor which covers the surface of the dentine and forms the walls of the cup. It does not reach the cavity of the pulp. It is thicker, and covers a greater extent on the anterior face of the tooth than it does on the posterior. (Fig. 12, *E E.*) This furnishes an important factor in determining the age of very old horses, when the tooth either becomes triangular or biangular. In the wall of the cup the enamel has about the same thickness throughout, although the difference of a transverse or an oblique section may give a deceptive appearance of a greater thickness at one point than at another

The enamel has a wonderful hardness. While still inclosed in the germinal sack it is readily cut by a knife and its elements can be dissected into **Z**-shaped prisms. From the moment that it is exposed to the air it becomes so hard that it will strike fire from flint. As it is more resisting·than the dentine, it constantly stands in relief on the surface of the table of the tooth.

HISTOLOGY.—The enamel is of epithelial origin, formed from the superior papilla of the primitive follicle. On microscopical examination it is found to be composed of an infinity of little hexagonal prisms, intimately joined and directed obliquely to the subjacent surface. The deepest layers lie immediately over the peripheral lacunæ of the dentine.

3. THE FUNDAMENTAL SUBSTANCE, DENTINE, EBURNATED SUBSTANCE, OR THE IVORY (Fig. 12, *I*).—This constitutes the major part of the tooth. It is produced by the inferior papilla or pulp, has a deep depression in its free extremity for the dental cup, and is covered by the enamel. It forms the walls of the pulp-cavity. In the forming tooth, the dentine consists of a thin layer juxtaposited to the layer of enamel formed by the superior papilla (Fig. 11, *d*); but as the tooth develops, successive layers are deposited on the interior of the first, and the ivory gradually encroaches upon and diminishes the size of the papilla lodged in the pulp-cavity until the latter entirely disappears.

The deeper layers have a darker color than the first, as in their continual infringement on the vascular papilla they imprison a portion of its organic matter and blood-supply until they have produced a complete atrophy of their progenitor.

This discoloration of the dentine we shall find later, on the table of the tooth, under the name of the "dental star," which becomes an important factor in judging of age after eight years. Strictly speaking, there are two stars, but the posterior is very rudimentary and of no practical importance. It is occasionally, however, seen very distinctly.

In Fig. 14 we have a series of longitudinal antero-posterior sections of incisor teeth from horses of different ages, which show the gradual diminution of the pulp-cavity from the encroachment of the dentine. The dentine toward the root of the tooth is always of a darker color than that toward the crown. The ivory is less hard than the cement, but much more resisting than either the cement or the bone in which the tooth is imbedded.

HISTOLOGY.—The dentine is channeled by a multitude of *canaliculi*, which radiate from the pulp and after frequent anas-

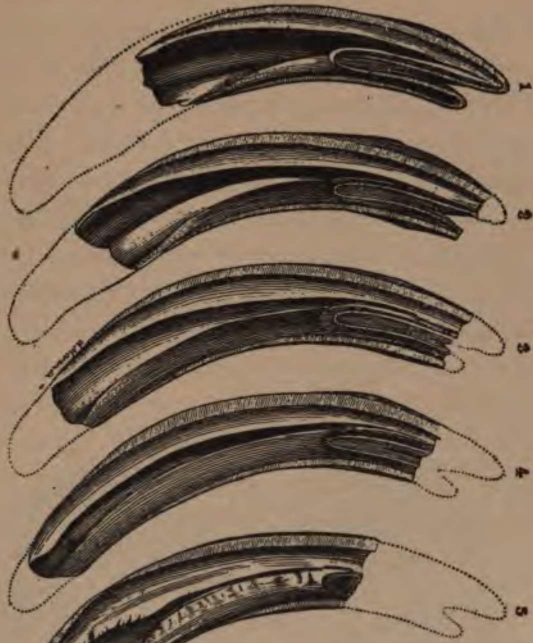


FIG. 14.

Antero-posterior and longitudinal sections of incisor teeth of horses of different ages, showing the gradual diminution of the pulp-cavity and the wearing of the free extremity. 1, 2, 3, 4, 5, 6, 7, and 8 are longitudinal antero-posterior sections of pincher teeth from horses of 3, 5, 7, 9, 15, 20, and 25 years of age, showing the growth of the teeth at their roots; the progressive wearing of the tables; the length and obliquity at different ages; the obliquity of the pulp-cavity; the cementation of the roots.

tomoses terminate in lacunæ under the deep layer of the enamel (*interlobular spaces of Czermak*).

THE TABLE OF THE INCISORS.—The table of the incisors is the free portion or crown of these teeth, which becomes worn by friction with the hard substances which the animal takes as food, and by the constant contact with the teeth of the opposite jaw. After the high anterior and lower posterior borders of the virgin incisors have been worn away the table is established. At first this consists, on each tooth, of an oblong plate, wider from side to side, which is surrounded by the layer of cement directly covering the peripheral layer of enamel; inside of this is found the zone of yellowish and softer dentine, usually somewhat depressed on account of its lesser resistance to friction; in the middle, the central enamel or border of the cup surrounds the variable quantity of cement which may be deposited in it. (Fig. 10; Fig. 12, *A*; Fig. 15.)

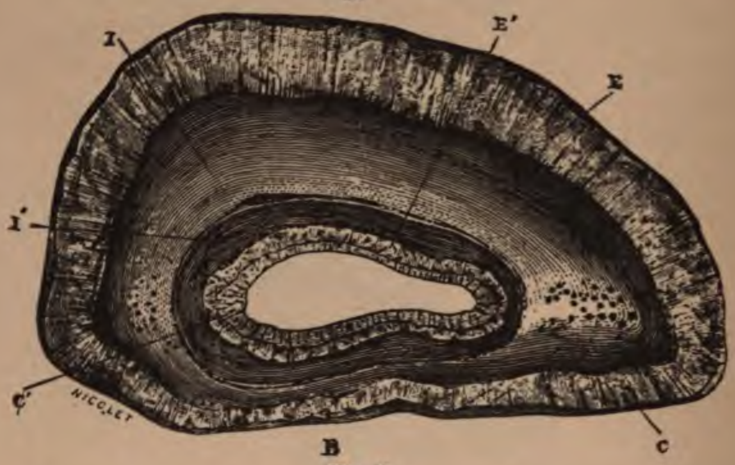


FIG. 15.

Transverse section of an incisor tooth. Inferior, right side. A, anterior; B, posterior; E, peripheral enamel; E′, central enamel; C, peripheral cement; C′, central cement; I, ivory, or dentine. (Enlarged.)

As the table gradually encroaches upon the wedge-shaped tooth (Fig. 16), it becomes proportionately narrower in its transverse diameter, and as it becomes oval in shape the cup is found nearer the posterior border of the tooth instead of in the centre. The dental star, or dark-colored dentine which takes the place of the papilla, now appears between the cup and the anterior border of the tooth (Fig. 12, *P*; Fig. 10, *B*.). A still further destruction from use brings the table to the middle of the original tooth; when it assumes the round form, the cup of central enamel has disappeared, and the dental star is now midway between the anterior and posterior borders. (Fig. 10, *C.*)

Still further use brings the triangular form, and finally the biangular; in these two forms the dental star gradually becomes larger, and, at times, when the papilla has not been entirely replaced by the dentine, a cavity is found which, by the uninformed, has been mistaken for the cup (Fig. 10, *C* and *D*), but should not be, as there is no surrounding enamel. Figure 16 shows the forms at the various parts of the original tooth.

THE DIRECTION OF THE INCISORS.—The direction of the incisors, or the position which they hold in regard to the jaw, is to be studied first in profile, considering the relative angle which the incisors of the upper and lower jaws have to each other; and second, in face, considering the position which they hold in regard to the median line.

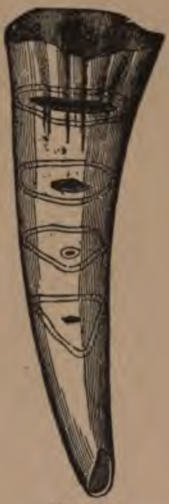


FIG. 16.
Scheme of sections of wedge-shaped incisor.

DIRECTION OF THE PLANE OF CONTACT OF THE TWO JAWS (Fig. 17).—In a young horse the incisors meet and form an arch which, if viewed in profile, represents the half of a circle; so that a tangent drawn from the point of contact of the two jaws is perpendicular to their tables. But as the progressive wearing of the table brings it nearer to the roots of the teeth, the half-circle changes to the form of an ogive, which becomes more and more acute as the surface of contact, which is displaced above and below parallel to itself, extends gradually from the primitive diameter. Consequently the tangents, $a\,a'$, $b\,b'$, $c\,c'$, drawn from the new points (a, b, c) of contact of the arches, are no longer perpendicular to this point, but tend to become parallel.

As the angle of incidence of the incisors increases in obliquity with age, and the horizontality of their arches indicates approximately the degree of the alteration,—excepting, of course, certain abnormal changes to be studied later,—we have in the profile of the jaw a valuable factor by which to judge of the age of the horse.

Direction in Regard to the Median Line (Fig. 18).—In the young horse, the crowns of the six incisor teeth widened from side to side, while their roots are flattened in their transverse diameter, cause the teeth to take a position on the end of the jaw like the ribs of an open fan. They diverge from the alveolar cavities, in which they are imbedded in the bone, toward the circumference formed by their crowns. But, as age advances, the crowns become worn off, and the teeth are pushed farther and farther out of their cavities. The roots, which were at first almost in contact with each other, gradually separate and widen, while the circumference constantly diminishes as the teeth

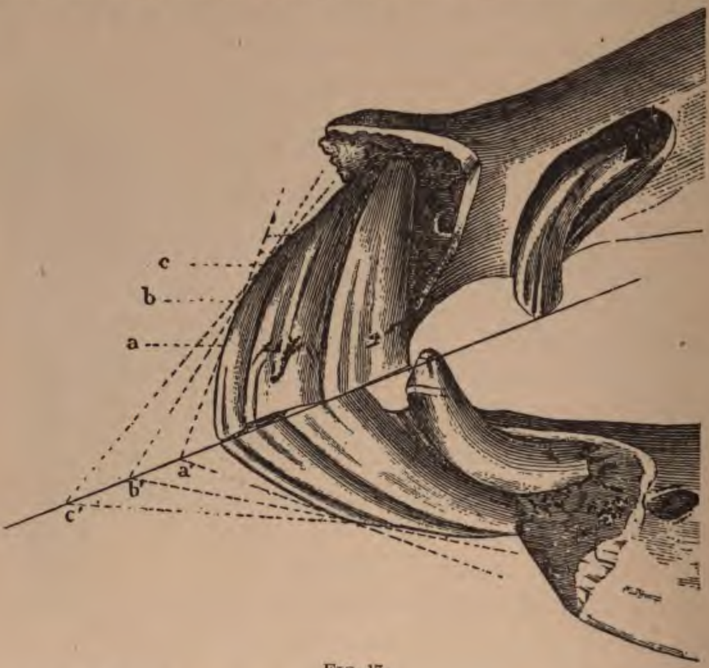


Fig. 17.
Arch of the incisors, uncovered to show their successive planes of contact.

become worn down, until they assume a parallel position, and finally converge, instead of diverging, at their free extremities. The intermediate teeth become separated from the pinchers on the one side, and the corner teeth become separated from them on the other, until a distinct space is visible between them, which is filled by a pale gum.

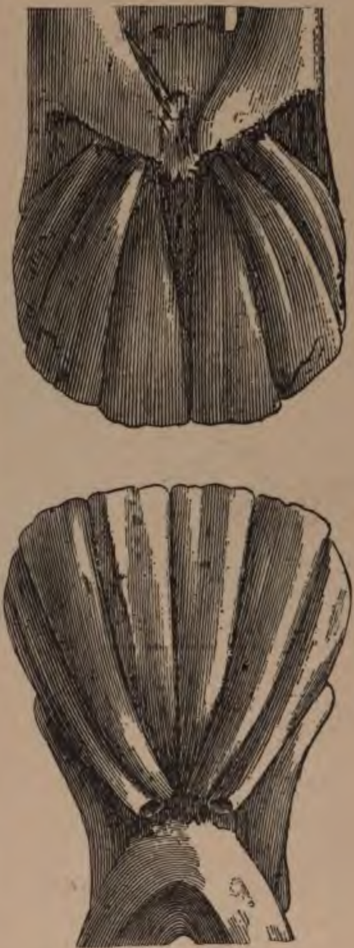


FIG. 18.

Incisors of the two jaws (roots uncovered), seen by their anterior face to show their direction in regard to the median line.

En résumé in regard to the general direction of the incisors:—

1. The incidence of the arches acquires a greater obliquity with age. 2. Their incurvation and their transverse diameter diminish. 3. The teeth, at first diverging from their roots, become parallel and finally converge toward their free extremities.

THE TUSHES, TUSKS, CANINE TEETH.

The tushes are four in number in the adult horse; they are rudimentary or absent in the mare. In certain sections of the country superstition has attributed sterility to mares provided with them, which is, however, absolutely unfounded.

The superior tusks are placed one on each side of the upper interdental spaces, at the point of union of the superior maxillary and intermaxillary bones. The lower ones are placed on either side of the maxilla, always closer to the incisor teeth than those of the upper jaw, so that they are invariably in front of the latter.

The canine teeth are curved in their long axis with the concavity backward, and they project slightly outward. The external face is covered with small, longitudinal, parallel striations. The internal face has a conical eminence pointing toward the free extremity of the tooth and separated from its borders by deep gutters. The tusks have a pulp-cavity relatively much larger than that of the incisors, which, however, also becomes filled with a discolored dentine as the tooth advances in age. As the tusks become used they show in their centre a dental star, which sometimes is very dark in color. While the tusks may be subject to much use from the friction of food, the tongue, lips, and the bit, they are always prominent, even in very old horses. Goubaux and Barrier have seen one case in which the tusks of the upper and lower jaw were in contact.

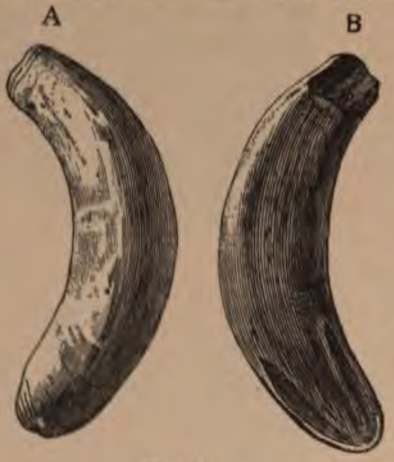


FIG. 19.

Upper right-hand canine tooth of a horse. A, external face; B, internal face.

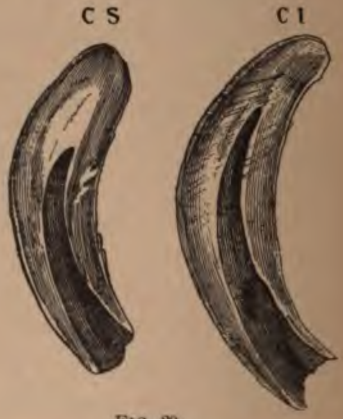


FIG. 20.

Longitudinal antero-posterior section of a horse's canine tooth. C S, superior canine; C I, inferior canine.

STRUCTURE.—The tusks are composed of ivory or dentine, inclosing a pulp-cavity and surrounded with enamel.

There are no temporary tusks in the horse, although small, rudimentary spicula sometimes are found before the permanent teeth appear.

MOLARS.

PREMOLARS—WOLF-TEETH.

THESE teeth, which were first described by Daubenton, are not found in all horses. They occur much more frequently in the upper jaw than in the lower one, and are rarely found in both in the same animal. Girard says that they usually appear about the tenth month, and drop out at the time of the eruption of the permanent molars. The alveolæ are usually directly in front of those of the first molars. They are, however, frequently a half-inch or more in front of the others, and often remain until the animal has reached an advanced age. Their presence renders the dental formula slightly variable (forty-four for the horse and forty for the mare). The wolf-teeth are elongated and slightly curved on their long axis; they resemble a good deal the incisive teeth of the carnivora, from which, perhaps, comes their common name. Their roots are unicuspid. Girard describes supplementary post-molars, which, however, are not recorded by other authors, and were probably anomalous teeth.

MOLARS.

The molars fill in the sides of the dental arch; like the incisors, they appear in two groups,—the temporary and permanent teeth.

MOLARS OF FIRST DENTITION.

The *deciduous*, *temporary*, *milk*, or *molars of first dentition*, are twelve in number,—six in each jaw, three on each side. By some curious error, the father of veterinary anatomy, Carlo Ruini, 1598, and his immediate followers, considered that there were but eight temporary molars.

These teeth are strong, short, and have the general form of quadrangular prisms, except the first in each row, which is triangular.

The anterior and posterior faces are smooth; in the upper jaw the first tooth has three longitudinal canals on its external face, while the second and third teeth have two; the internal faces are irregular, slightly concave in their long axis, and show canals very much less marked than those on the outside.

The inferior teeth on their external face have a single gutter, which is deepest in the first tooth and most shallow in the last; on their internal face they are irregularly grooved. All of the milk-molars have a constriction or neck separating their crowns from their roots. They have each two roots, one anterior and one posterior. These are strong, convex outside and concave inside; each is hollowed by an opening which reaches into the tooth itself. Just before being forced out by the permanent teeth the roots are sometimes divided into little eminences by the pressure of the irregularities on the crowns of the latter. The free extremities of the virgin milk-molars are irregular and

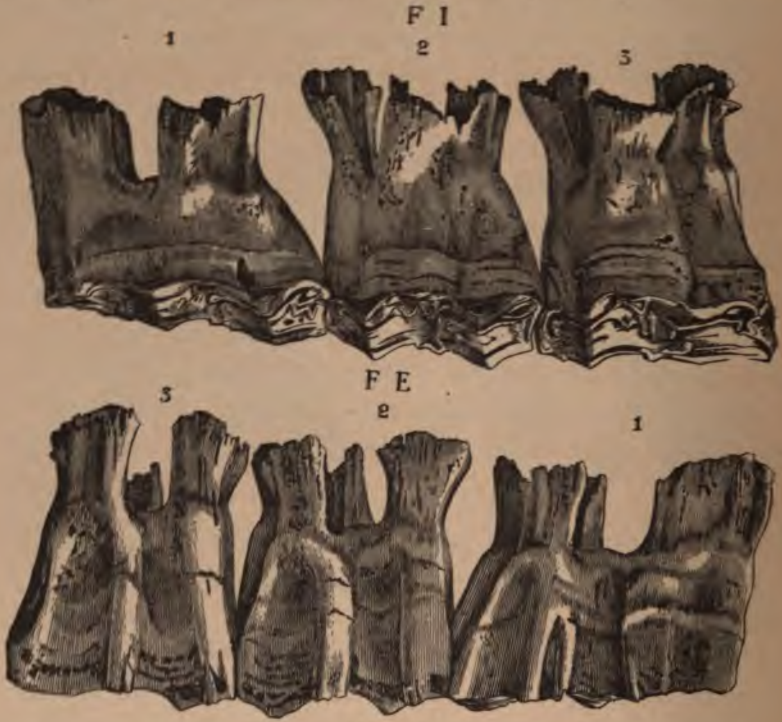


FIG. 21.
The three superior temporary molars (right). F I, internal face; F E, external face.

covered with ridges and cavities, but the external border of the superior teeth and the internal border of the inferior teeth are always longer than the opposite border, so that they present two oblique planes, which become more marked as the teeth wear down. As the animal becomes older the molars wear down till they are reduced (Figs. 23 and 24) to little thin plates, which fit close to, or cap, as it were, the crowns of the replacing molars, by which they are finally forced out from the jaw.

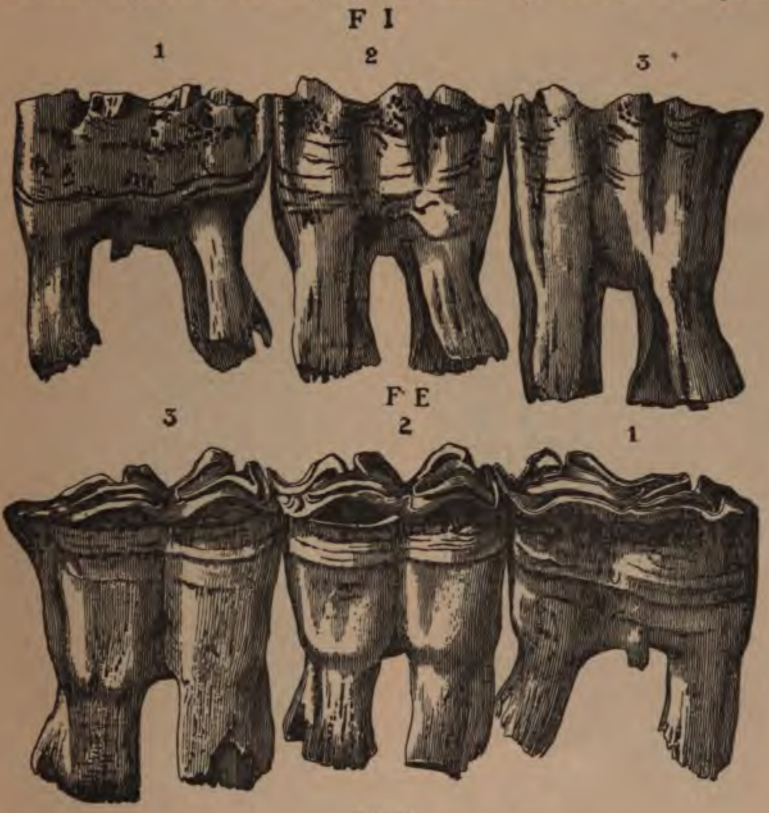


FIG. 22.

The three inferior temporary molars (right side). F I, internal face; F E, external face.

MOLARS OF SECOND DENTITION—PERMANENT MOLARS.

These are twenty-four in number,—twelve in each jaw, six on each side. They are designated numerically from in front to behind, as the first, second, etc. The three first, which replace the temporary molars, are known as *pre-molars*, and the last three as the *post-molars*. Each row of six molars forms a branch of the dental arch, which in the upper jaw is slightly convex to the outer side, while in the lower jaw it is perfectly straight, with the anterior extremities inclined toward the other, so that they form a sort of **V**, and are overlapped by those of the upper jaw.

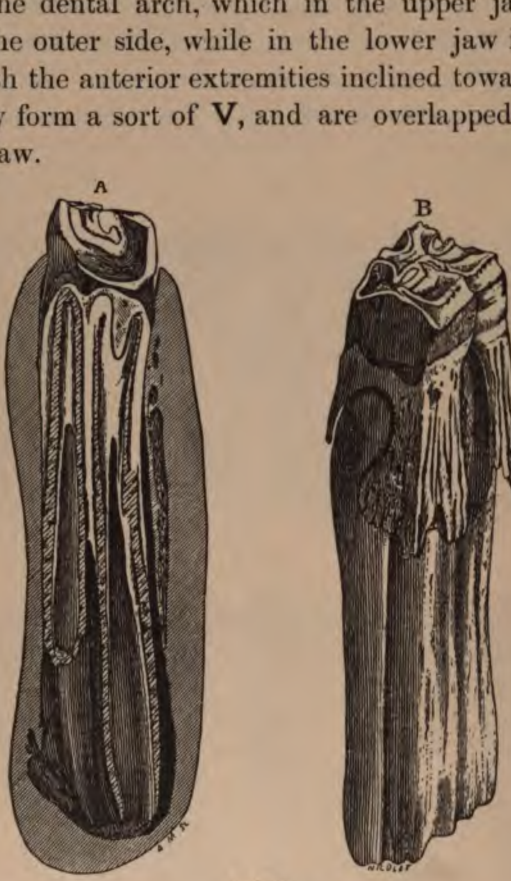


FIG. 23.

A, transverse section of the lower jaw, showing the third temporary molar and its relation to the permanent molar which replaces it. B, third inferior permanent molar, capped by the worn temporary molar.

The permanent molars have the shape of quadrangular prisms flattened from side to side, except the first and sixth, which are triangular.

SUPERIOR MOLARS.—The posterior faces are almost smooth, except in the sixth molar, where the face is replaced by a blunt edge; the anterior faces are also smooth, except that of the first molar, which is replaced by a sharp border.

The external faces have two longitudinal gutters separated by a ridge; the first molar has three gutters with two ridges; the internal faces have two shallow gutters on the first molar and one on each of the others, which is closer to the posterior border of the teeth in the last ones. There is no neck or distinctive line (Fig. 24) separating the crown or free extremity from the roots or imbedded extremity of the permanent molars. The free extremity is triangular in the first and sixth teeth, and quadrangular in the others. In the virgin tooth it has an irregular surface resembling an Old English 𝔅, with loops looking

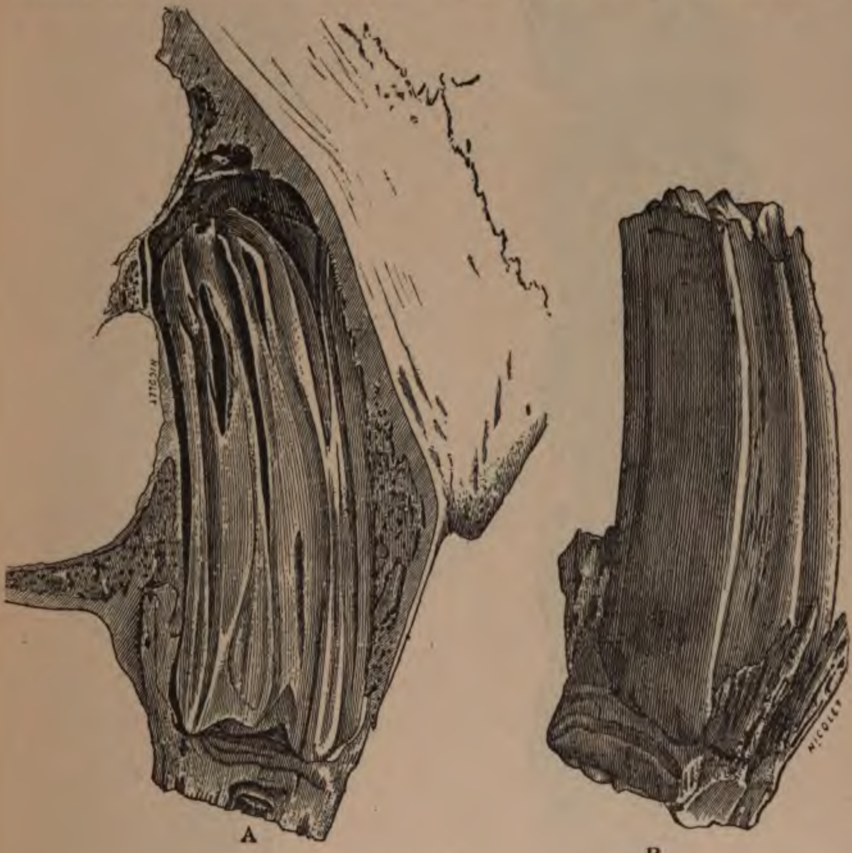


FIG. 24.

A, transverse section of the upper jaw, showing the left third temporary molar and its relation to the permanent molar which replaces it. B, third permanent molar, capped by the worn temporary molar.

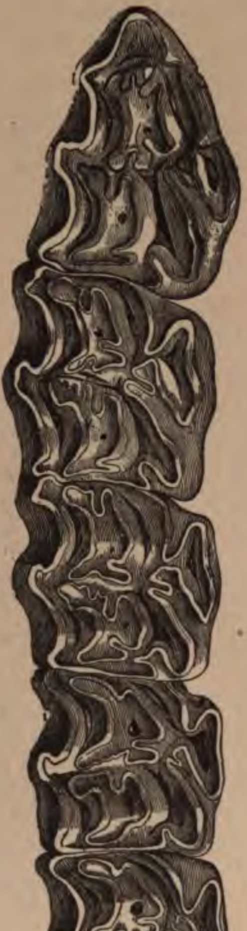


FIG. 25.

Right-hand superior molars of a horse 6 to 7 years old. First molar at top of figure.

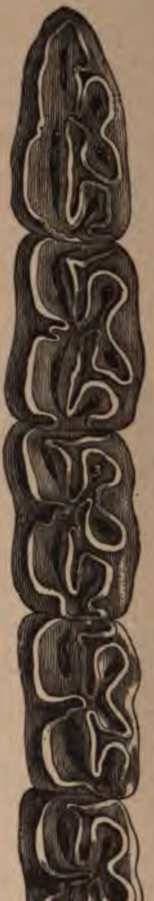


FIG. 26.

Left-hand inferior molars of a horse 6 to 7 years old. First molar at top of figure.

toward the inside and surrounding cavities, which are more or less filled with cement; to the anterior loop is attached a small, secondary loop. The external border is always longer than the internal. As the tooth wears and the table is established, the cavities disappear. At first the imbedded portion is hollowed by cavities, which reach the body of the tooth itself and contain the papilla, or pulp, formed principally of blood-vessels and nerves; later, these resolve into distinct roots, three each for the first and sixth molars, and four each for the others. According to Girard, these become distinct at five years of age.

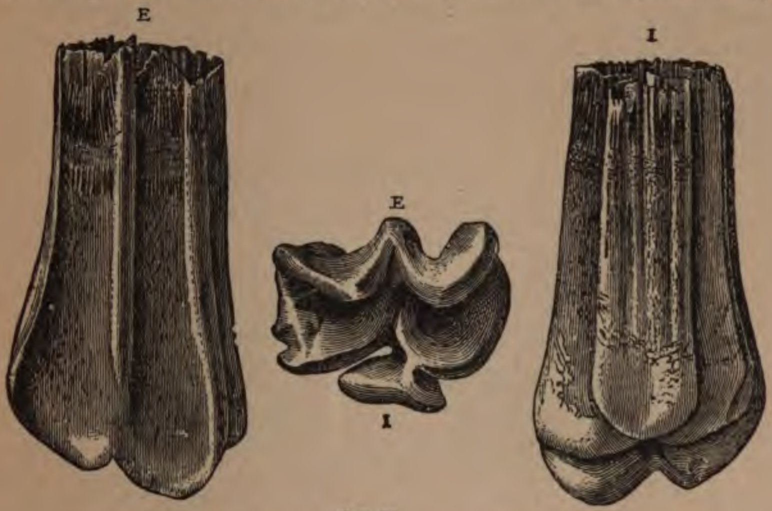


FIG. 27.
Superior permanent molar (right side),—virgin tooth. E, external face; I, internal face; E I, surface of contact.

(Fig 27.) If the head is placed horizontally the first molar is found imbedded in a vertical position, while the others incline somewhat from below to above and from in front to behind.

The superior molars are implanted in alveolar cavities, prismatic like the teeth, and separated from each other by bony septa, which are thin at their free borders and thicker above. The bottoms of the three last project into the maxillary sinuses, while those of the three first are in the superior maxillary bone itself. In very old horses the sinus may reach the root of the third or even second tooth.

INFERIOR MOLARS.—The anterior and posterior faces are flat, except the posterior of the sixth tooth and the anterior of the first tooth, which are replaced by sharp edges. The external faces have one longitudinal gutter in the first five teeth and two in the sixth tooth. The internal faces have three gutters in the first and sixth teeth and a variable number in the others. The free extremity is triangular in the first and sixth molars and quadrilateral in the others; but these are narrower from side to side than from in front to behind. They are longer on their internal border than on the external, and have the Old English 𝕭 turned with the loops outward. The imbedded portion is bicuspid in the first five teeth and unicuspid in the sixth. The divisions of the roots diverge; each contains a cavity for the pulp.

DEVELOPMENT AND STRUCTURE OF THE MOLARS.

In the superior molars the papilla of the enamel in the germinal sack is double and penetrates into the tooth, forming, practically, two infundibula, one anterior and one posterior, instead of one cup, as in the incisor teeth. The papilla of the pulp makes five diverticula, which almost appear to be as many separate cavities.

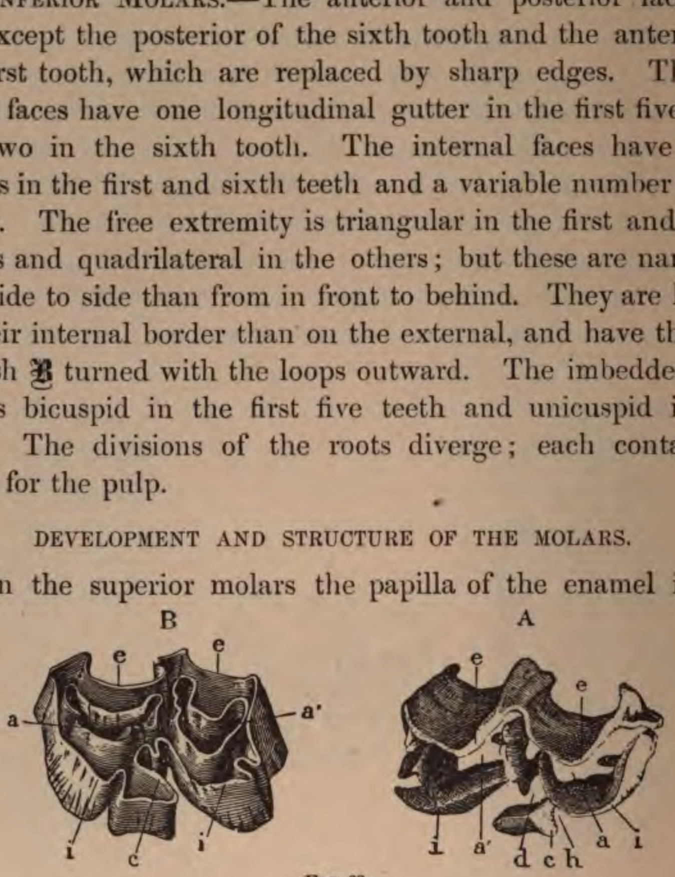


FIG. 28.

A right superior molar taken from the dental follicle. A, view from free end; B, view from the imbedded portion; a, anterior infundibula; a', posterior infundibula; e, external border of the infundibula; i, internal border of the infundibula; c, accessory column of the anterior infundibula.

In the inferior molars there are two infundibula, one occupying the middle portion of the tooth and one toward the anterior portion, which allows us to recognize a left-hand inferior molar from its right-hand homologue. The arrangement of the infundibula of the papillæ of the root is practically the same as in the superior molars.

The molars, like the incisors, are composed of a fundamental substance and two covering layers.

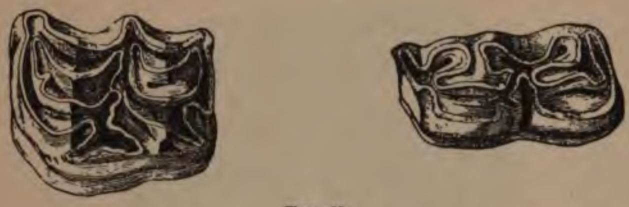


FIG. 29.

Grinding table of a superior molar (left).

Table of an inferior molar (right).

A. The Enamel forms the bulk of the tooth. It covers the four faces and is reflected into the infundibula. On the table of a molar which has been worn down it forms the bright lines which form the Old English 𝕭.

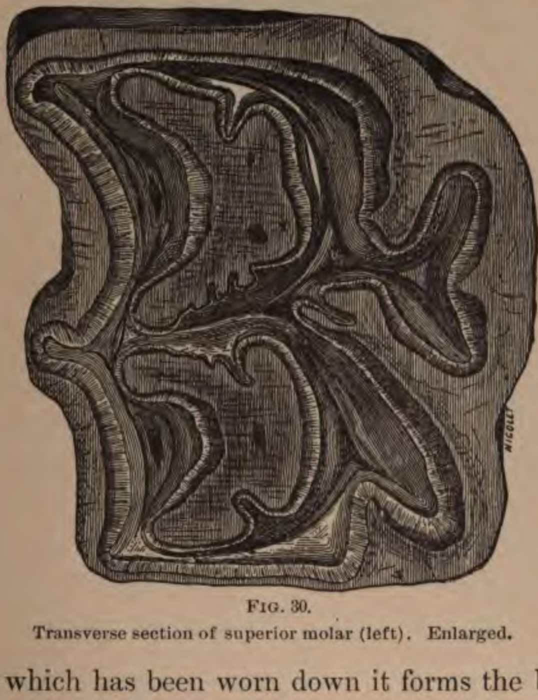


FIG. 30.

Transverse section of superior molar (left). Enlarged.

B. The Ivory or Dentine is deposited on the internal face of the enamel, and finally fills up the diverticula of the pulp-cavity. At first it is entirely protected by the enamel, but as the table is formed it becomes exposed, and, as it is softer than the other substance, becomes worn more rapidly, and renders the wearing surface uneven and better adapted to grinding.

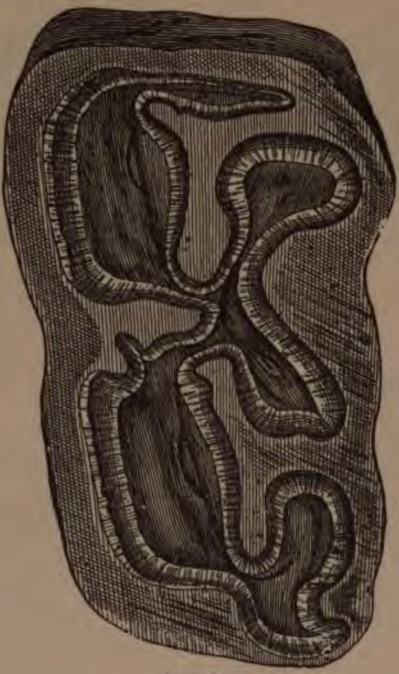


FIG. 31.
Transverse section of an inferior molar (right). Enlarged.

C. The Cement is very abundant on the molars. It covers the enamel, fills the infundibula of the enamel, and, in very old mouths, is often formed in excess, and furnishes a new wearing surface to replace the teeth themselves, which have been destroyed by use.

ERUPTION OF THE TEETH.

ERUPTION OF THE INCISORS.

THE eruption of the deciduous incisors does not cause any marked constitutional phenomena, although it may cause some slight loss of appetite,—due, however, rather to the local pain in chewing than to any general disturbance. With the appearance of the permanent teeth the head increases in size and becomes more full, which is due principally to the space demanded for the large molars of second dentition.

The appearance of the permanent teeth is a period of general irritation of the animal economy. The first attack of periodic ophthalmia frequently appears at this time; colts seem more susceptible to contract strangles and other of the contagious diseases.

Sometimes the temporary incisors drop out before the appearance of the permanent teeth; in this case they leave a small ulcer in the gum, which is followed by a swollen, red, sore point, through which finally the replacing tooth appears by its internal corner, which is followed by the anterior border, set not in its future proper position, but obliquely to the axis of the jaw. When the temporary teeth have been pulled to hasten the age, as is a growing custom in some of our neighboring markets, the obliquity remains, and when found in an apparent five- or six-year-old mouth should always be regarded with suspicion. At other times the milk-teeth remain, and the permanent ones protrude on their posterior border. Convulsions may occur by excessive pressure and irritation in these cases. The incisors of the upper jaw usually appear before those of the maxilla. The pincher, intermediate, and corner teeth appear in succession by pairs.

Causes which can Hasten or Retard the Eruption of the Incisors of the Second Dentition.—All ordinary horses are supposed to be born on the 1st of May, while thoroughbreds are supposed to be born on January 1st, and each dates its age accordingly. We may, therefore, have horses which officially have the same age vary from each other in their real age by some months.

Races which develop slowly, a debilitated temperament, and an impoverished nourishment, all tend to retard the eruption of the teeth, while, on the contrary, precocious races, strong feeding, etc., hasten the appearance of the full mouth. Gestation in the young mare retards the eruption of her teeth, especially of the corner teeth, which mark the five years. In cold, damp climates the teeth are several months later in appearing than they are in warmer and dryer climates. The thoroughbred and all improved horses develop their full mouths earlier than their less well-bred relations. Exceptions may occur in both extremes. A rising three-year-old has been known to have all of its permanent incisors, and more frequently a six- or seven-year-old is seen with its corner milk-teeth.

ERUPTION OF THE TUSKS.

The appearance of the tusks is so variable that it is of little value as an indication of age. They are usually absent in the mare, and in the horse or gelding may be out at three years, or may not pierce the gums until the animal has had all of its other permanent teeth. The *lower* tusks frequently appear almost a year in advance of the upper ones. They usually appear at about the same time as the corner incisors.

ERUPTION OF THE MOLARS.

As the young horse becomes older the deciduous molars become worn down until they only exist as thin plates which cap the crowns of the first three molars of permanent dentition and are but loosely held in their alveola. They become broken, and the sharp points wound the neighboring cheek, causing difficulty of mastication, which can frequently be relieved by removal of the loosened teeth.

The two first molars of first dentition are through the gums at birth, or within a few days of it. The third appears at the end of the first month. The authorities are not in accord as to the appearance of the permanent molars, as will be seen in the following table:—

DESIGNATION OF TOOTH. PERMANENT MOLARS.	EPOCH OF ERUPTION.		DESIGNATION OF TOOTH.		EPOCH OF ERUPTION.
	GIRARD.	MAYHEW.	INFERIOR MOLARS.	SUPERIOR MOLARS.	SECELLIER.
4th	10 months.	12 months.	4th	4th	10 and 12 mos.
5th	20 months.	18 and 24 mos.	5th	5th	20 and 24 mos.
1st	30 and 32 mos.	. . . . .	1st and 2d	1st	30 and 36 mos.
1st and 2d	. . . . .	36 months.	6th	6th	32 and 36 mos
2d and 3d	36 months.	. . . . .	3d	2d	40 and 42 mos.
6th	4 and 6 years.	. . . . .	. . . . .	3d	44 and 48 mos.
6th and 3d	. . . .	60 months.			

According to Secellier, the inferior milk-molars fall constantly before those of the upper jaw, while the eruption of the permanent molars of both jaws takes place at the same time.

DURATION OF THE LIFE OF THE HORSE.

According to Buffon, the duration of the life of the horse is, as in all other species of animals, proportionate to the duration of its growth. Man, who is fourteen years in growth, lives six or seven times that length of time; that is to say, he may live to 90 or 100. The horse, which requires about four years to attain its growth, may live six or seven times that length of time; that is, to twenty-five or thirty years. Examples which are contrary to this rule are so rare that they need hardly be regarded as exceptions of consequence; as the more common draft-horses acquire their growth in less time than better-bred horses, they also live a shorter time,—fifteen or sixteen years.

According to Bourgelat, "the age of the horse can be estimated at eighteen to twenty years. The number of those which pass this age is excessively small."

Aristotle noted that horses which are nourished in stables live for a shorter time than those which are raised in herds; the conditions of slavery and domesticity diminish their powers of resistance to the wear and tear of life.

Athenæus and Pliny claim to have known the horse to attain the age of sixty-five or even seventy years. Augustus Nipheus speaks of a horse belonging to Ferdinand I which was over seventy, but these observations are only exceptions similar to those which we sometimes find in the human species.

Hartman and Buffon both note that the life of mares is generally longer than that of horses. This observation was already made by Aristotle (Hist. Animal., lib. v), and corresponds to the same rule in the human race, where women generally live to a greater age than men. Hartman claims that it is "an undoubtable sign that a breeding horse is well bred and in good health when it is slow in development. Those which do not attain their complete growth until six or seven years, excepting in cases of accident, are useful for twenty years or more, and may still be sound and healthy at thirty years. The other ones, on the contrary,—those which attain their growth in four years,—rarely pass the age of twenty."

The great, heavy draft-horses, which attain their growth in even less time, are already aged at ten or twelve years. Examples of horses of thirty, thirty-six, and forty years of age would not be so rare among our animals if the tyranny and hard usage imposed upon them by men did not aid greatly to shorten their lives. Ordinarily, as soon as a horse has seen its best days, it is sold from the stable in which it has been kept, to be replaced by more useful animals, and it goes rapidly into the hands of the hackman and the huckster, doing harder work with less nourishment, until it becomes completely used up, and depreciates to the value of the knacker's price.

Among the principal causes which modify the longevity of the horse may be counted the length of time of development, the size of the horse, the work to which the animal is put, and the care which it receives.

We find certain races and certain individuals which are precocious in their development, and other races and subdivisions of families in which longevity is hereditary.

M. Bouley says: "There are tardy races and precocious races. In the last the precocity is the result of the combined influence of heredity and alimentation, in which the organic formation acts in a precipitous way, as it were, in those individuals which compose it, and we find a hasty achievement of development; from which it results that the duration of their first part of life is so much shortened, and, as a fatal consequence, also that of their whole life; for this more rapid development, impressed on their organisms, has no other termination, from the industrial point of view, which produces it, than to hasten the moment of death."

The small races of horses and small individuals last usually for a longer time than larger ones. We can make no satisfactory explanation of this, unless it is that in the larger animals the wear and tear is greater from the very fact of the animal having so much more to take care of in itself. The character of work to which the horse is put is an important factor in shortening the life,—due to the fatigue entailed and the using up of the powers of the organs. We find that a horse with a quiet and docile disposition will perform heavier and rougher work, with less deterioration in its animal economy, than one alongside of it of a nervous and excitable disposition. The more calm and quiet life of horses in the country is less prejudicial to their existence than the bustle and confusion of the great industrial centres and crowded streets of our large cities.

Again, the necessities of rapid and variable work and irregular hours of feeding in great cities predispose to internal diseases, while the greater loads and rough pavements lead to strains of tendons, wrenches of bones, bruised feet, and other injuries which soon render the animals unserviceable, or condemn them to return to the softer ground, lighter work, and more regular life of the country, with, however, a broken-down constitution. The care which the horse receives from its keeper—which, of course, includes the regulation of work and feed—is an all-important matter. A kind, judicious owner will work horses for years and keep them sound and in good condition, doing a vast amount of work; while in the next stable, under the guidance of a careless or brutal owner, equally good horses will perform less work and become worthless in a short time.

The word "*used*" applied to horses has become synonymous with the word "*aged*" applied to man, and indicates the time when the animal has become prematurely old.

Examples are not rare in which the horse has attained the age of thirty, thirty-six, forty, and even more years, and has been in perfect health and capable of moderate useful service.

PRINCIPLES OF EXAMINATION FOR DETERMINING THE AGE OF THE HORSE.

To any one accustomed to horses it is an easy matter to distinguish at sight the very young from the adult horse, and the middle-aged from the very old animal. In very old animals white hairs commence to show in the neighborhood of the temples and around the eyes and the nostrils, if the color of the animals is dark; gray and roan horses become very much lighter in color, and even at times nearly white; the inferior extremity of the head becomes pointed, and the sides of the face become depressed; there is an evident change in the line of the back and loins, which become depressed (sway-backed). The *aplomb* of the legs and the blemishes found on them are common witnesses of work which has lasted for a number of years.

In addition to the examination of the teeth, which is frequently considered the only point that need be looked at to determine age, there are many other points which are of very great value.

We have seen that the molar teeth of the very young animal are deeply imbedded in the alveolar cavities of the jaw-bone, and that when the animal becomes older the teeth are gradually pushed out from these cavities as the free extremities of the tooth become worn away. The molars are pushed out and the jaws become thinner by absorption of the bone, which is no longer needed as a bed for holding the teeth, which are diminished in size. We find, then, that, as the horse becomes gradually older, the branches of the jaw-bone, which in the young animal were thick and rounded, become gradually thinner and sharp on their border, and form a very accurate indication of the approximate age of the animal.

In an old Arab book of agriculture, by Ibn-el-Awamm, written about the twelfth century, it is stated that "one of the signs by which an old horse can be recognized is to pinch between the thumb and index finger the skin of the forehead and draw it out, and then to let go of it quickly. If the skin returns promptly to its place and becomes perfectly smooth, the animal will make a good horse," etc.

In Aristotle we find the same statement prescribed as an indication of age: "If the skin returns promptly to its place and leaves no wrinkle, the animal is young; if the skin remains wrinkled, it is old."

An old and neglected, but useful, means of approximating the age of old horses is by means of the "knots" in the tail. These knots are little, prominent eminences on either side of the base of the tail, formed by the transverse process of the coccygeal bones. The processes can be felt in young horses, and become especially prominent after the emaciation of a severe illness, but in this case they are rounded and are apparently continuous with the other tissues, while in old horses, due to absorption in the bone itself, they become more distinct, and seem to stand out in the muscles and softer structures of the tail.

The knots are felt distinctly at the base of the tail when the horse has attained the age of thirteen years. In two years later, when they have become more prominent, they have behind them a distinct little depression two or three lines in width. At sixteen a second pair of knots are found, which, like the first, in about two years, have behind them a distinct depression, and so on, every three years, a new pair of knots furnish an approximately accurate indication of the age of the animal.

The teeth, however, are by far the most important witnesses of the age of the horse. The examination of these, which includes the incisors, the tusks, and the molars, shows (*a*) if the incisive arch is composed of teeth of the first or second dentition, or of both; (*b*) if there is a normal number of them; (*c*) the situation, length, breadth, and the angle which they have in the maxillary bones; (*d*) if the tables of the teeth touch each other, or if one overreaches the other, which somewhat modifies the leveling of the table; (*e*) the color and substances on the face of the teeth; (*f*) if they have been subjected to fraudulent handling.

In the incisors we study the form and details of the table, the direction and length of the tooth, and the condition of the corner tooth. In the tusks we note the amount of use to which the teeth have been subjected, their direction and their length. In the molars we look for the number and the dentition to which they belong, the condition of their grinding surface, their length and direction and the integrity of their substance, and that of the gums which surround them.

CHARACTERS FURNISHED BY THE TEETH.

The reader may, perhaps, have wondered why we should have gone into such minute detail in the anatomical description of the teeth, but an accurate knowledge of all these details is absolutely necessary, when we take into consideration the slow, insensible, and variable wearing, producing often only trivial changes, which are, however, important guides.

Washed incessantly, rubbed, used, and broken as the teeth are by the action of the saliva, the lips, the cheeks, the tongue, and the food which the animal takes, we have to take into consideration every detail of their structure, their position, the breed and general condition of the animal, and the surroundings in which it has been raised. A thoroughbred with dense bones and hard teeth will wear the latter away much more slowly than a coarse-boned, lymphatic, common horse with softer substances in the teeth. The character of food to which a colt has been accustomed will stimulate or diminish the functional activity of the tooth, and, while hard substances would naturally wear a tooth faster than softer food, yet the animal which has been raised on the former will often have harder teeth than one which has not had to use them so severely.

Any one who has only been accustomed to examine the mouths of horses of one section of country will find that he must extend his ideas and adapt himself to a new condition of things, when called upon to judge of the age of horses from another region.

If a horse's mouth presents exactly the characters which indicate a certain number of years of growth, we say that it "*is* — years;" if it has not quite attained the age, it is described as "*rising* — years;" if it has passed the period and has not yet attained the markings of another year, it is counted as "— years *off*."

The natural division of the two periods of age, as indicated by the temporary and the permanent teeth, is subdivided as follows:—

1. The period of eruption of the incisors of first dentition.

2. The leveling of these teeth and their progressive use.

3. The period of the falling out of the deciduous teeth and the appearance of the permanent ones.

4. The leveling of these latter.

5. The successive forms which their tables present as the teeth become worn away.

FIRST PERIOD.

ERUPTION OF THE INCISORS OF FIRST DENTITION.

At Birth.—At the birth of the foal the incisors have not yet pierced the gums. The anterior border of the pincher and intermediate teeth can be seen under the mucous membrane, which is rendered paler than the surrounding tissues by their pressure. (Figs. 32, 33, 34.)

About One Week.—The pincher teeth have generally appeared in from six to eight days, the upper teeth preceding the lower by twenty-four or forty-eight hours. At this age the teeth are of little importance; for the general aspect of the animal, its manner of walking, which is still unsteady, and the condition of its hairs show that it is but a few days old. (Figs. 35, 36, 37.)

About One Month.—The intermediate teeth appear between thirty and forty days, just as the interior border of the pincher teeth commence to be worn. (Figs. 38, 39, 40.)

About Three Months.—There are now four teeth in the upper and four teeth in the lower jaw; the pinchers have commenced to wear on their posterior borders; they are entirely free from the gum. (Figs. 41, 42, 43.)

About Four Months.—The incisive arch has become wider; the inferior intermediate teeth are free from the gum; their anterior border has commenced to be worn away toward their inner edge as it comes in contact with the corresponding superior teeth. (Figs. 44, 45, 46.)

About Five Months.—The pincher teeth have pushed through the gums to the line of the neck of the teeth; the intermediate teeth are worn on their anterior borders; the mucous membrane is often sensitive along the posterior border of these teeth on account of the corner teeth, which have commenced to push out. (Figs. 47, 48, 49.)

About Six Months.—The intermediate teeth have pushed farther out; their posterior borders have come in contact with each other. In the region of the corner teeth the mucous membrane is puffy and congested; sometimes even at this age the anterior border of the corner teeth shows under the soft tissues.

About Eight to Ten Months.—The anterior borders of the corner teeth are seen through the mucous membrane. The intermediate teeth are entirely through the gums to the level of their neck. The inferior incisive arch forms a regular half-circle. (Figs. 50, 51, 52.) It is not important to be more precise at this age, as various causes influence and produce slight variations in the eruption of the teeth and in their leveling. Some animals are strong and vigorous, while others are weak and feeble; some have been well fed, while others have been nourished badly; and, again, we find individual peculiarities of precocity and tardiness in the eruption of the teeth as in other evidences of development. At the outset, the foal only uses the milk of its mother; at this time there is little friction and using of the teeth, except from their simple position and contact with each other. As the foal gets older and commences to use fibrous and resisting food the incisors wear away more rapidly; there is always the most use in the pincher teeth. Moreover, during this first period of the life of the animal, while it is still with its mother, other conditions allow us to judge with sufficient accuracy as to the age of the animal, which is not ready to be sold or removed until it has been weaned.

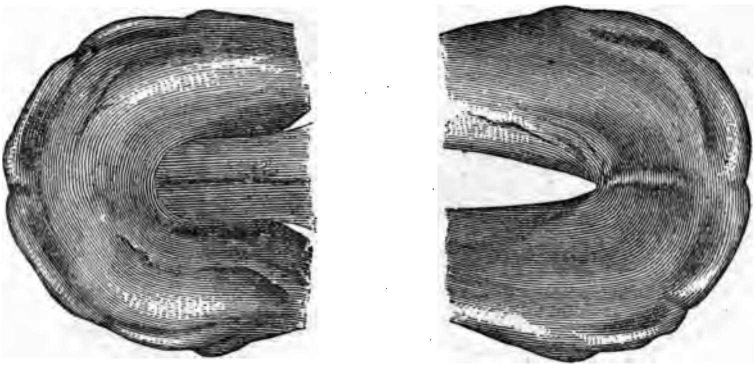


FIG. 32.

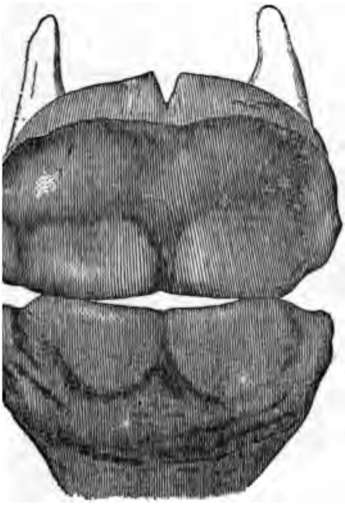


FIG. 33.

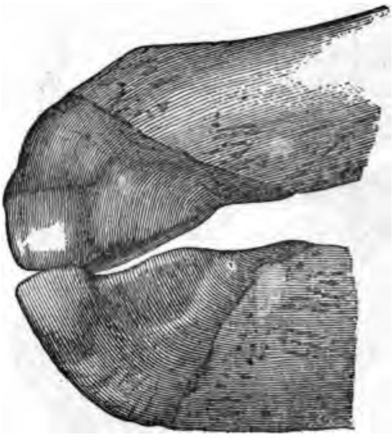


FIG. 34.

At Birth (Figs. 32, 33, 34).—The incisors are not yet out. The mucous membrane still covers the teeth, which are about to appear. In front are seen under the gums the two pinchers, above and below. In profile are seen the intermediate teeth, less developed than the pincher teeth. The jaws are rounded. The dental table shows on the side a little ridge formed by the anterior border of the pinchers, with a less distinct elevation for the intermediate teeth on the side; the edge of the teeth near the symphysis of the jaw is higher than the outer edge, and comes through first.

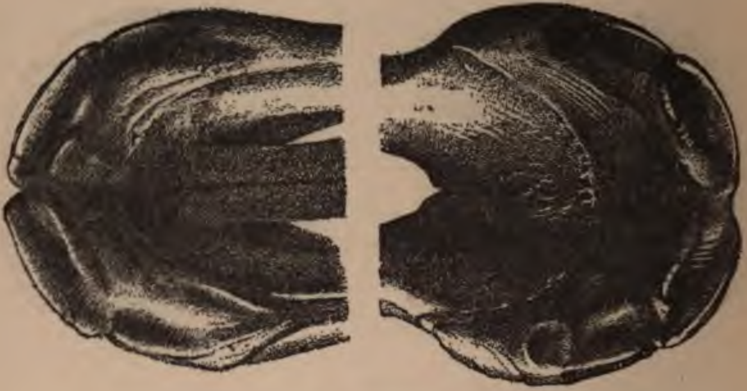


FIG. 35.

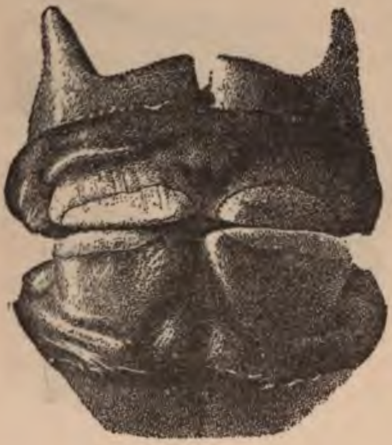


FIG. 36.

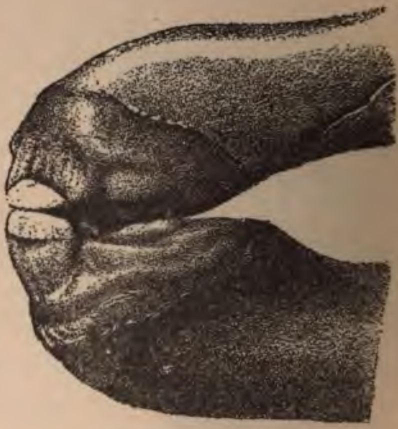


FIG. 37.

One Week (Figs. 35, 36, 37).—The pincher teeth are through th gums. In face, the anterior borders are seen. In profile, the gum are thinned on the intermediate teeth. The tables show the anterio borders of the pinchers through and depressions over the posterior borders.

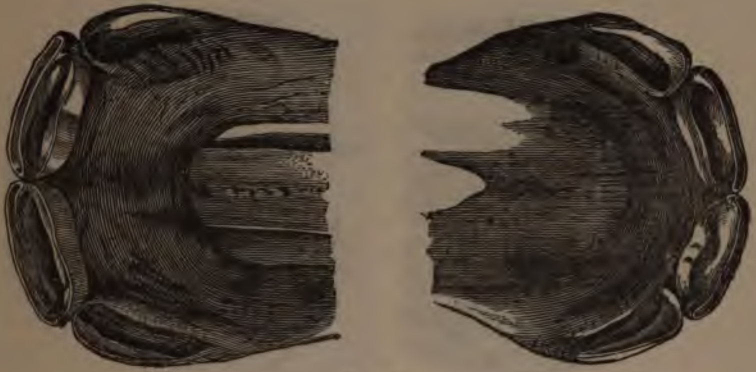


FIG. 38.

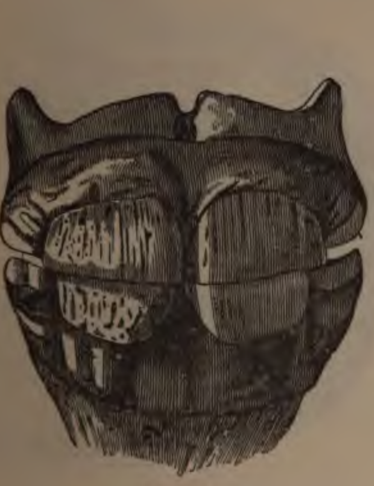


FIG. 39.

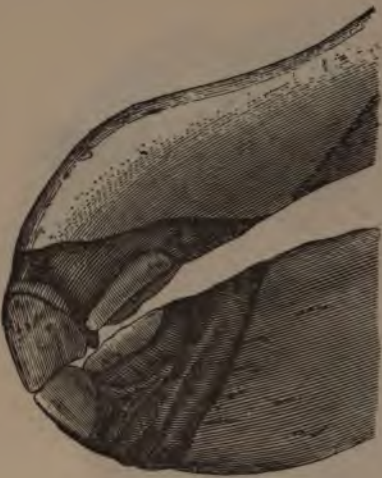


FIG. 40.

One Month (Figs. 38, 39, 40).—In front the pincher teeth, which appeared during the first week, are in contact with each other; their anterior face is striated with little gutters. On the side, the anterior border of the intermediate teeth is seen. In profile, the jaws are seen thicker; the gums still cover part of the anterior face of the intermediate teeth. The dental tables are uncovered in the pinchers. There is a slight use of both borders of the teeth above; below, the anterior border only has been worn. The membrane still covers the posterior border of the intermediate teeth and a portion of their dental cup.

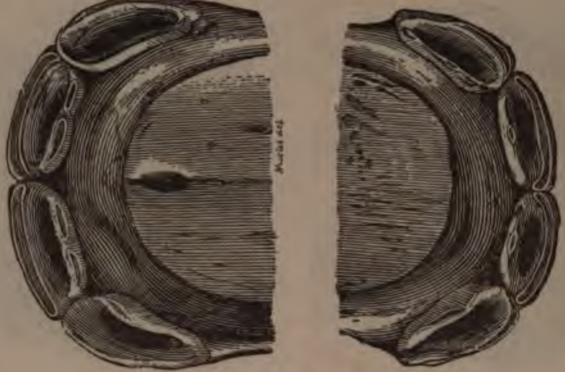


FIG. 41.

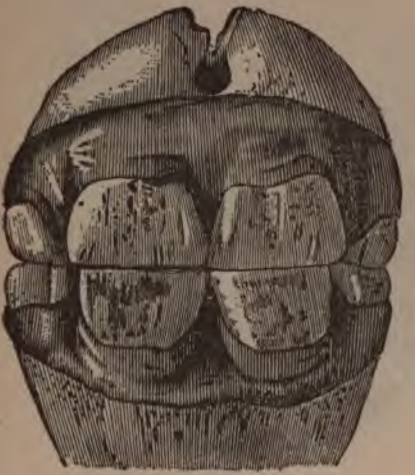


FIG. 42.

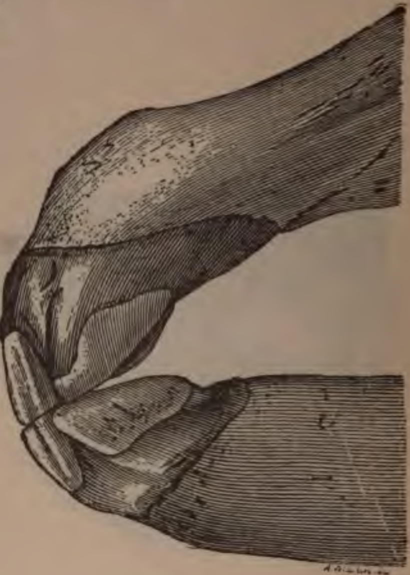


FIG. 43.

Three Months (Figs. 41, 42, 43).—From in front, the pincher teeth are seen almost entirely free, though the gums still encircle the base of their free portion. The intermediate teeth are in contact by the internal portion of their anterior border. In profile, the jaws are seen wider, thicker, and less curved; the intermediate teeth are not yet completely free. Their free borders are separated behind; the dental tables are slightly used; both borders of the intermediate teeth are slightly worn toward their inner edge. The incisive arch increases in extent transversely.

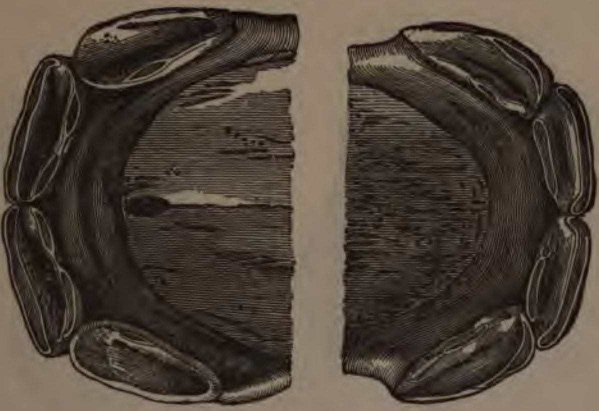


FIG. 44.

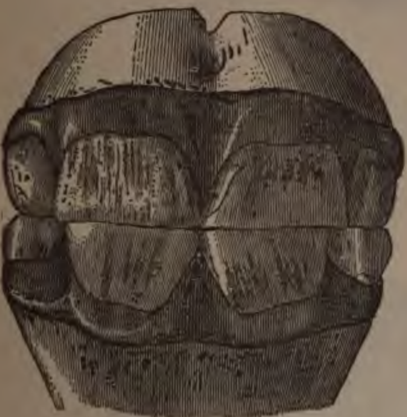


FIG. 45.

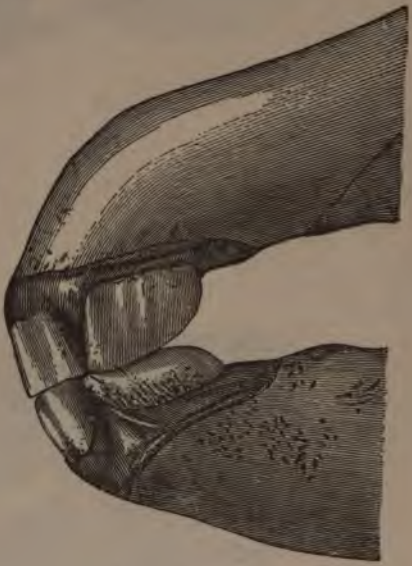


FIG. 46.

Four Months (Figs. 44, 45, 46).—From in front the transverse diameter of the jaws is increased; the intermediate teeth are further out.

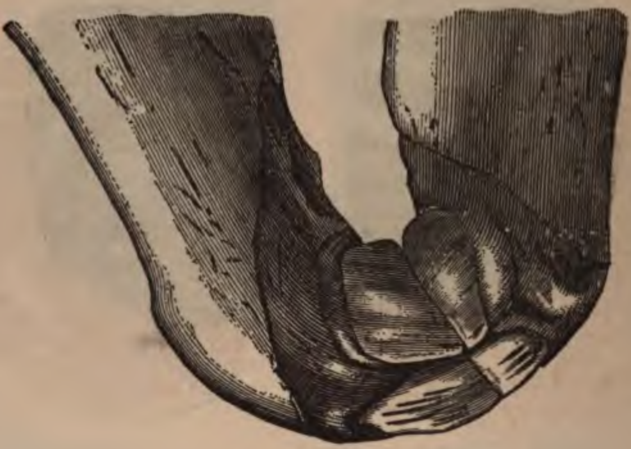


FIG. 47.

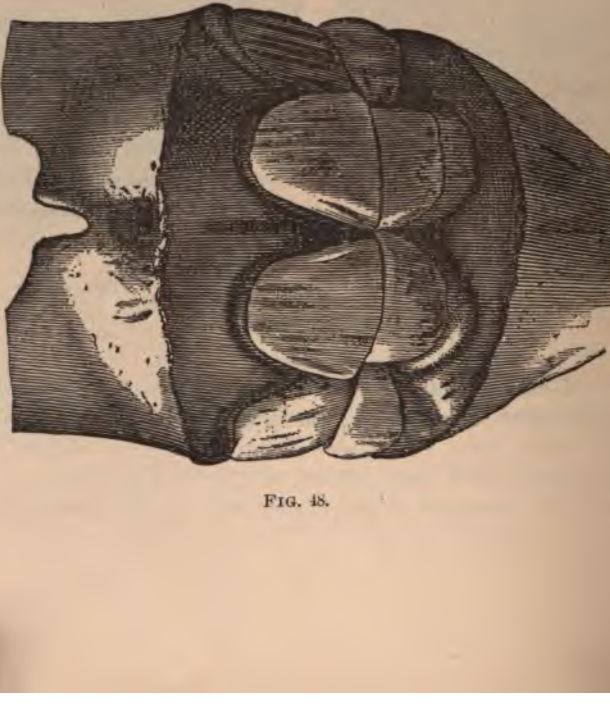


FIG. 48.

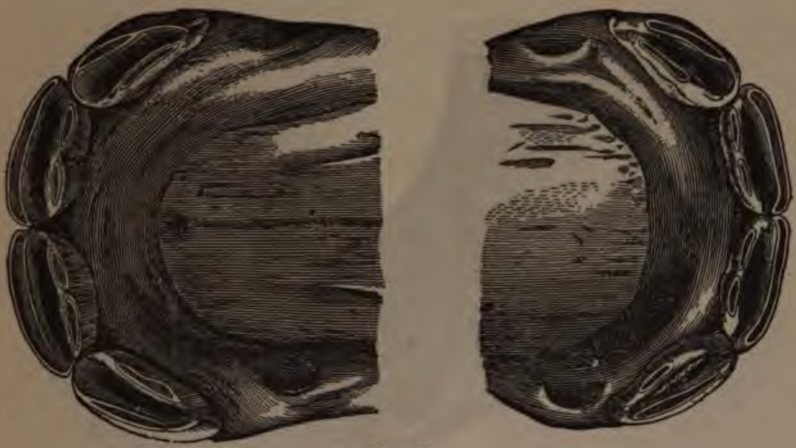


FIG. 49.

Five Months (Figs. 47, 48, 49).—The jaws are thicker and the incisive arch is wider transversely. From in front the intermediate teeth are seen almost entirely free. In profile these teeth are in contact by the whole extent of their anterior border; the table of the pinchers are more worn, especially above. In each jaw the anterior border of the intermediate teeth is worn almost for its whole length; the posterior border is less worn. Below is seen, under the mucous membrane, the internal edge of the corner teeth, which are preparing to pierce through. They form a little elevation of the mucous membranes placed immediately behind the internal border of the corresponding intermediate teeth.

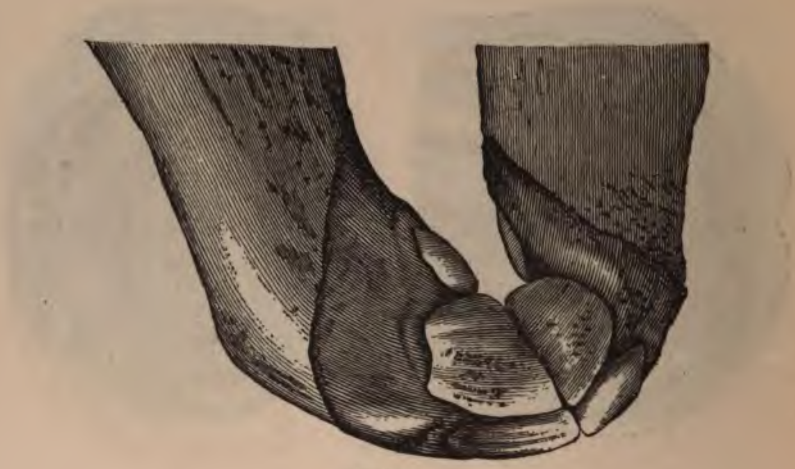


FIG. 50.

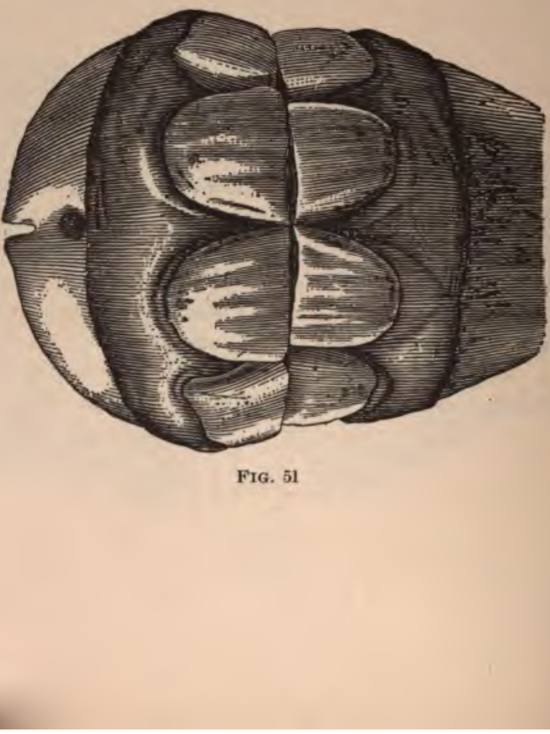


FIG. 51

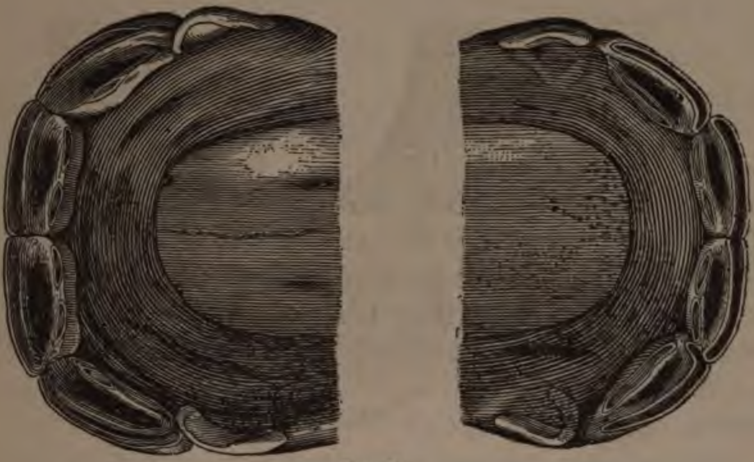


FIG. 52.

Ten Months (Figs. 50, 51, 52).—These jaws come from a pony which was rather tardy in marking its age; nevertheless, they are useful plates from which to study the diverse characters of this period. The pinchers and intermediate teeth are entirely free from the gum; the anterior face of these teeth is polished, the little striations or canals are less visible; the intermediate teeth, which have been in contact for some months, are worn on both borders. The corner teeth are just appearing, but are not yet in contact with each other. The wearing of the pincher teeth is greater than that of the intermediate teeth.

SECOND PERIOD.

LEVELING, PROGRESSIVE USE, AND FALLING OUT OF THE INCISORS OF FIRST DENTITION.

About One Year.—The corner teeth have protruded from the gums, but the inferior ones are not yet in contact with the superior teeth. The inferior pinchers, if not leveled, are at least very much used on both their borders. The incisive arch commences to be a little depressed in the centre. The superior pinchers and intermediate teeth just commence to wear at their posterior borders. (Figs. 53, 54, 55.)

About Sixteen Months.—The superior corner teeth meet the inferior and commence to wear at their anterior border; the necks are clear of the gums. Often at this time the inferior pinchers are leveled, but the intermediate teeth are rarely more than slightly worn. The incisive arch is flattened in front. (Figs. 56, 57, 58.)

About Twenty Months.—The inferior corner teeth are nearly leveled; the superior ones are less so. The inferior pinchers stand out from the gums, and the intermediate teeth are often leveled. The incisive arch becomes less convex. (Figs. 59, 60, 61.)

About Two Years.—The inferior dental arch is completely leveled at the pinchers and intermediate teeth, and the superior arch is nearly so. The superior pinchers stand out from the gums, and behind them is found a moderately sensitive swelling,—due to the permanent teeth, which are pressing on the gum of the palatine arch. The intermediate teeth are free from the gums above and below. The incisive arch has widened from side to side and the pinchers and intermediate teeth form almost a straight line. (Figs. 62, 63, 64.)

Girard thought that the pinchers were leveled at ten months, the intermediate at one year, and the corner teeth at fifteen to twenty-four months, but this is too definite; the leveling of the temporary incisors is somewhat irregular, and is considerably modified by the depth of the cups, the amount of cement which they contain, and the character of the food upon which the animal is fed. Experience will teach the observer to place much value on the condition of the corner teeth, the amount of wear of the superior incisors, and upon the color, which gradually becomes darker. At the end of this period the pinchers become broken, loose, and ready to fall from their sockets; they are less solidly fixed in the jaw and may be broken off, or are pushed out naturally by the permanent teeth, which replace them.

During this period, especially during the second year, the variations in the amount of wear of the teeth in different animals may be very marked; but, by a careful comparison of the use which each pair of teeth—pinchers, intermediate, and corners—have undergone, and, with close observation of the development and size of the bones, taking into consideration the intermaxillary bones, and the width and thickness of the body and branches of the maxilla, a very close differentiation of a month or two may be made. Especial note must be made of the amount of gum which still covers the crown of the teeth, or their freedom from the gums, the discoloration on their surface, the polishing off of the small striations, and the evidence of the protrusion of the permanent teeth under the gums behind the deciduous teeth.

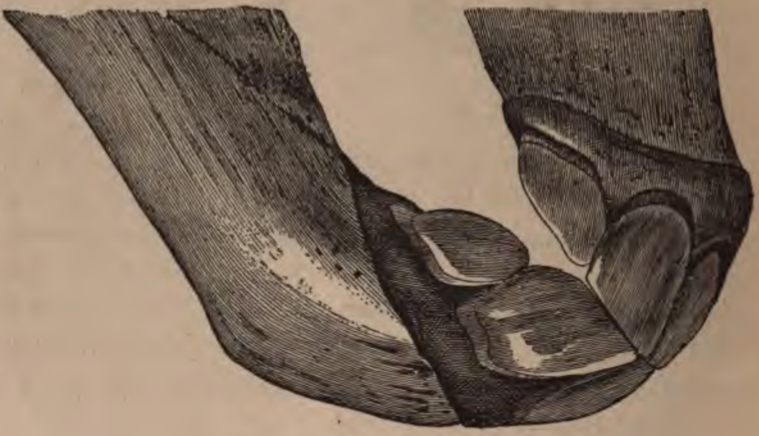


FIG. 53.

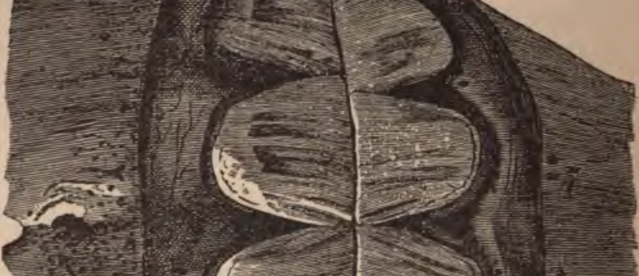


FIG. 54.

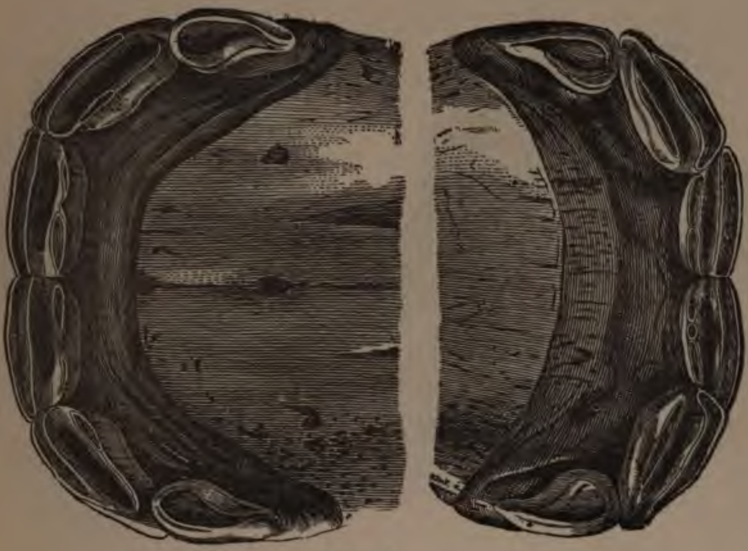


FIG. 55.

One Year (Figs. 53, 54, 55).—All of the deciduous incisors can be seen from in front; the pinchers and intermediate teeth are entirely free from the gums. In profile the superior corner teeth are not yet in contact with the inferior teeth. The tables show a decided use on the posterior borders of the intermediate teeth, which, however, is subject to variation, according to the height of the posterior border in different colts. There is generally seen at this time in the anterior border a yellow line, elongated transversely, which represents the elementary dental star. The corner teeth are still virgin. Comparison must be made between the wear of the pincher teeth and that of the borders of the intermediate teeth, and according to the amount of use which the latter have had the animal can be judged as *rising* or *off* the age indicated by the other marks.

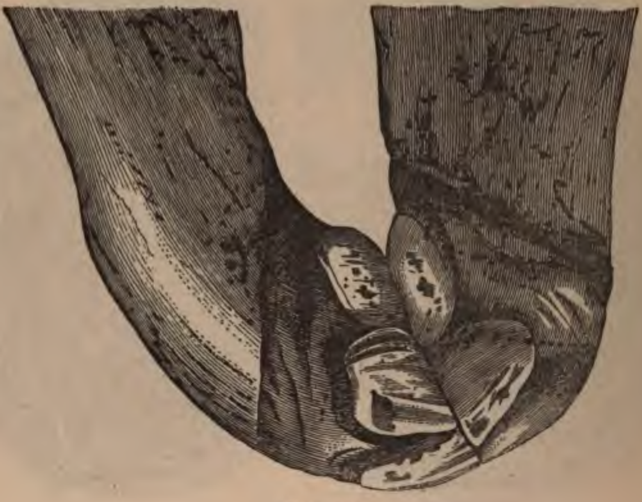


FIG. 56.

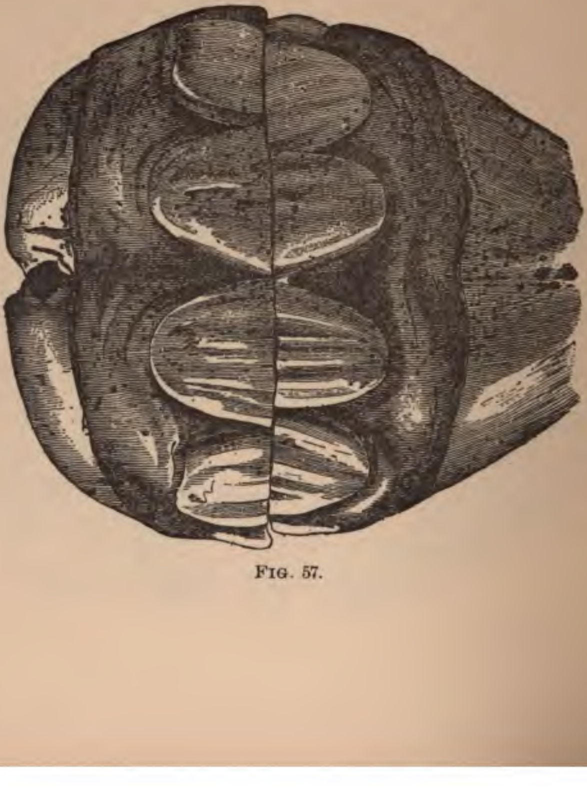


FIG. 57.

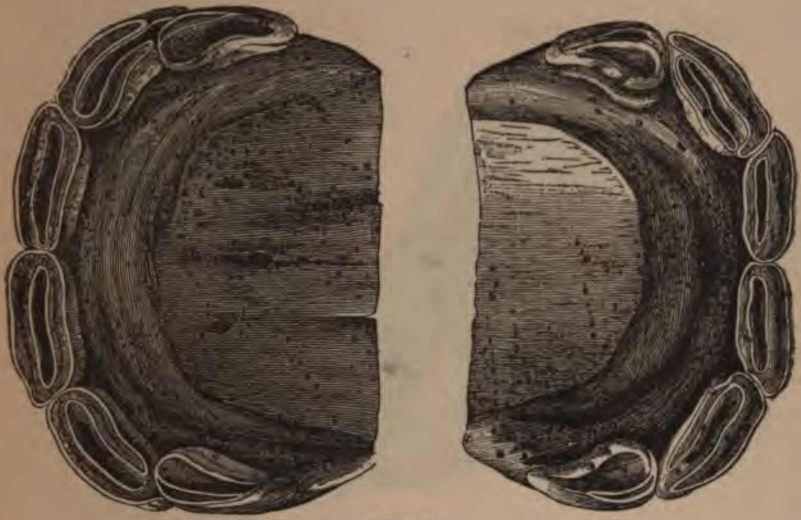


FIG. 58.

Sixteen Months (Figs. 56, 57, 58).—All of the teeth are in contact. The superior corner teeth are in apposition with the inferior, and have commenced to be leveled in both jaws; the enamel of the cups and the peripheral enamel are separated; the crown of the tooth is entirely free from the gum. Often at this period the inferior pinchers are leveled, and sometimes the inferior intermediate teeth are also leveled. In the upper jaw the tables of all teeth are entirely formed, the incisive arches lose their convexity.

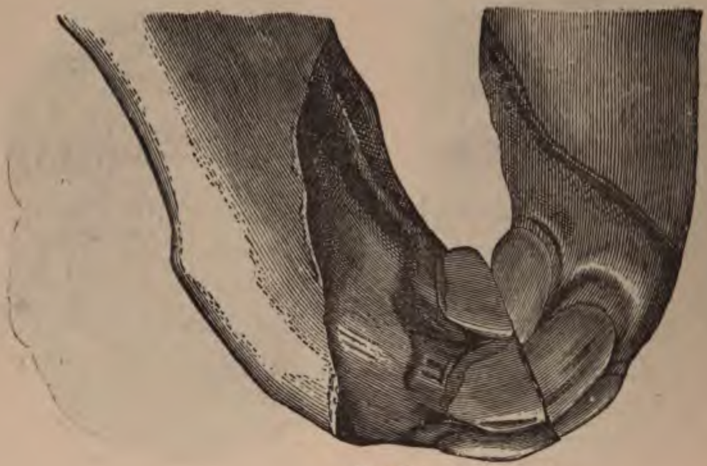


FIG. 59.

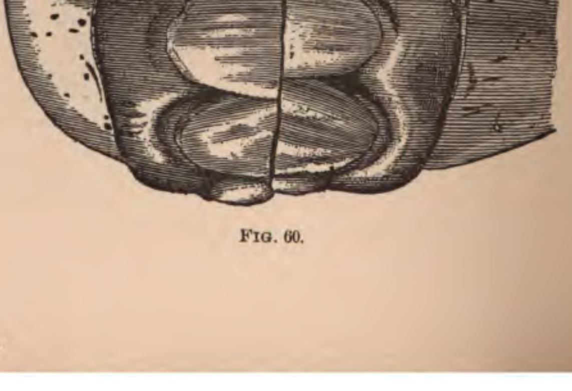


FIG. 60.

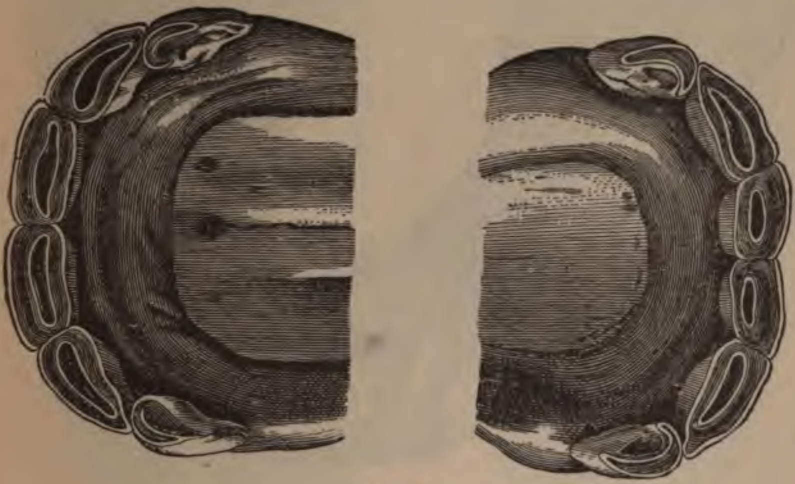


FIG. 61.

Twenty Months (Figs. 59, 60, 61).—This mouth comes from a thoroughbred colt, which was grain-fed from birth. It represents more use than should be at this age. The inferior corner teeth are leveled on their anterior border; the superior corners are somewhat worn, but not even comparatively to the degree of use of the pinchers and intermediates. The inferior pinchers are completely worn, and the inferior intermediate teeth are leveled; the incisive arch has become less convex, but not wide enough for a two-year-old; a bit of the gum still remains around the roots.

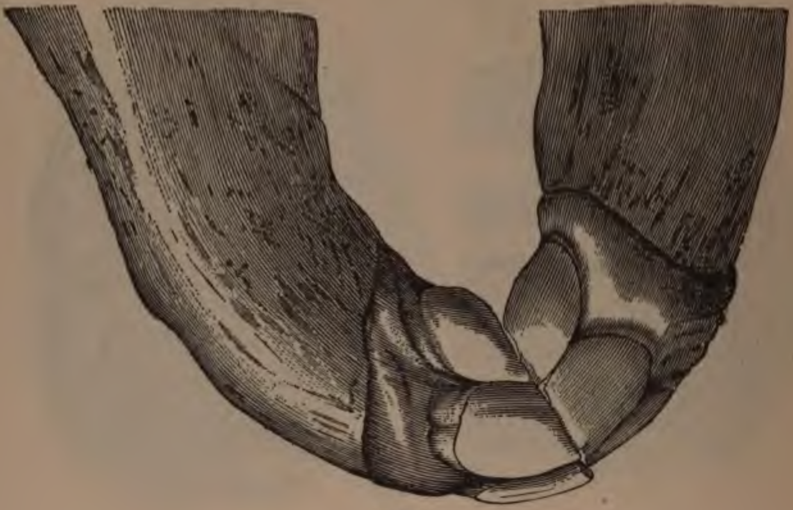


FIG. 62.

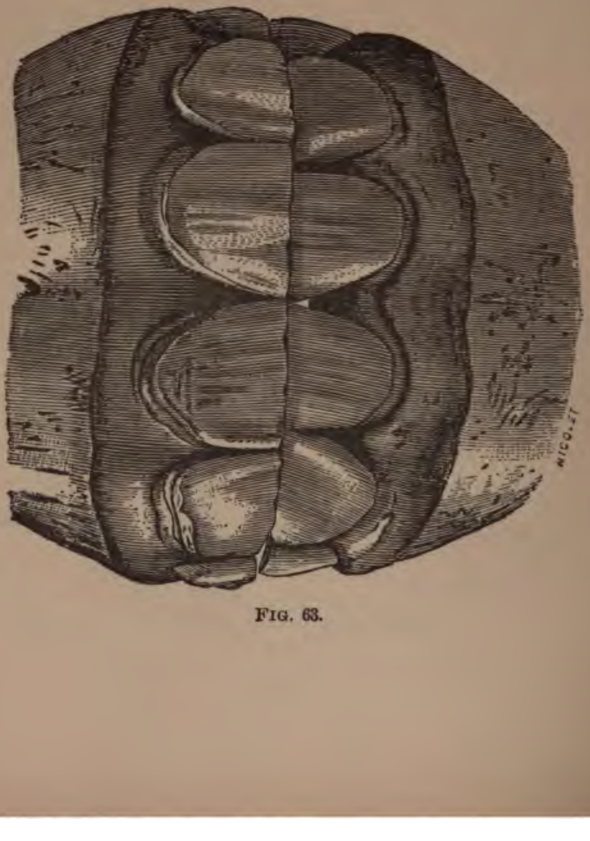


FIG. 63.

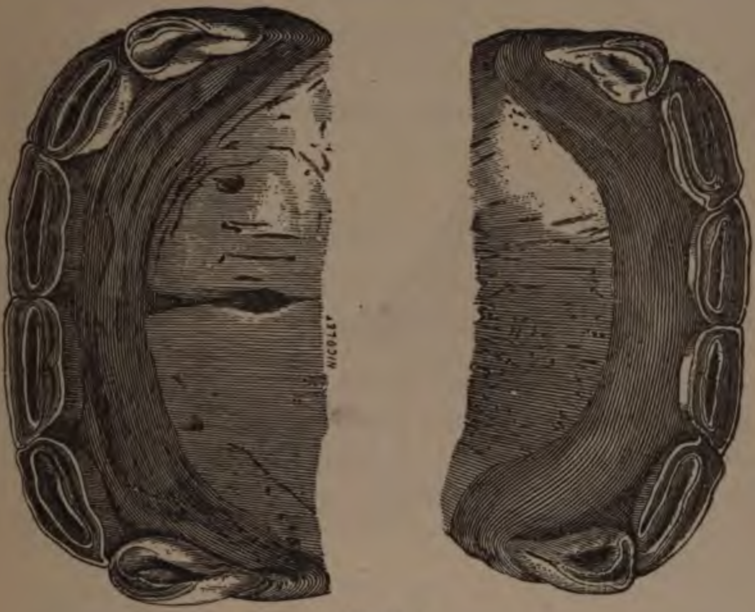


FIG. 64.

Two Years (Figs. 62, 63, 64).—This mouth comes from a common-bred colt which had no grain feed. It was two years and twenty-six days old. From in front the pinchers and intermediate teeth are seen free from the gums, indicating that they are pressed on by the permanent teeth. In profile, the corner teeth are free to their necks. The tables are well worn, and the dental stars show. The cups of the superior intermediate teeth are free from the peripheral enamel. The incisive arch is widened transversely.

THIRD PERIOD.

ERUPTION OF THE PERMANENT OR ADULT TEETH.

THIS period commences at the age of two or two and a half years, and finishes at five years.

About Two and a Half Years.—Successive falling out of the temporary pincher teeth; swelling of the gums and appearance of the anterior borders of the permanent pinchers. Ordinarily these teeth appear in the superior jaw first, and the piercing of the gums is completely effected in about six weeks to two months.

Rising Three Years.—As the colt is approaching the age of three years, we find in the superior jaw the permanent pinchers wholly out of the gums and almost reaching the level of the temporary intermediate teeth. In the inferior jaw, the borders and sometimes a greater extent of the free extremities of the teeth have appeared through the gums, though the teeth are still virgin; the intermediate temporary teeth are free from the gums at their neck, and very much worn. The corner teeth are worn so that they touch each other by their external borders. (Figs. 65, 66, 67.)

Three Years.—At three years of age all of the permanent pinchers are out of the gums and have reached the level of the temporary teeth. The permanent pinchers are wider transversely, square, and darker in color than the temporary teeth, and show little gutters on their anterior face. They differ distinctly from the others, which are smaller, more convex, have a constriction in the neighborhood of the gums, are whiter, and are not marked with gutters.

The time of the year and the race of the animal must be taken into consideration in determining the completion of three years. The better breeds of horses attain that age in midwinter, while those of more common races do not attain it until the months of March, April, or May.

Three Years Off.—When the colt is several months from three years of age the permanent teeth are well used on their borders and in contact with each other, but the dental cups are not yet complete circles, as the enamel which forms them is still connected with the peripheral enamel toward the borders of the teeth. The intermediate teeth are very much worn, protrude from the gums, and are sometimes broken and ready to fall out. The tables of the corner teeth have become very much larger and almost cover the external borders of the teeth. (Figs. 68, 69, 70.)

Rising Four Years.—Eruption of the permanent intermediate teeth and progressive falling out of the temporary intermediate teeth mark this period. The permanent intermediate teeth appear, but have not yet reached the level of the tables of the corner teeth, and are not yet worn. The central enamel in the pincher teeth surrounds the dental cup, which is flattened from in front to behind, and is almost distinct. The corner teeth commence to be free at their necks from the gums. (Figs. 71, 72, 73.)

Four Years.—Each jaw shows four permanent teeth, with their tables on the same level; the intermediate teeth are worn both on their anterior and posterior borders, but the dental cups are not entirely separated from the outside peripheral enamel. Often the inferior pincher teeth are leveled, especially in well-bred horses. The temporary corner teeth stand out from the gums and are completely worn. (Figs. 74, 75, 76.)

Four Years Off.—Loosening and successive falling out of the temporary corner teeth, which are worn to stumps, scarcely fastened in their alveolar cavities. Sometimes one or more of the corner teeth have fallen out, and we find the inferior borders of the permanent corner teeth appearing first, more frequently in the upper jaw. The pinchers and intermediate teeth are well worn. At this period we frequently find anomalies in the eruption of the teeth. It is not rare to see the intermediate and corner teeth appear at the same time; so that an animal which is only four or four and a half years of age may have the teeth which ordinarily indicate five years. (Figs. 77, 78, 79.)

Rising Five Years.—The four temporary corner teeth have fallen out and are replaced by the adult teeth. These last have not yet reached the level of the intermediate teeth and are not yet worn. The pinchers are leveled; their central enamel, elongated from side to side, is found farther and farther away from the anterior border of the dental table. The tables of the intermediate teeth are distinctly formed. (Figs. 80, 81, 82.)

Five Years.—The mouth is complete; the incisive arch is semicircular and regular in shape; all of the permanent teeth have reached the same level. The anterior borders of the corner teeth are completely worn. The posterior are not yet worn. (Figs. 83, 84, 85.)

Five Years Off.—The above characteristics are more distinct. The age has been more marked by the continual friction and amount of work to which the corner teeth have been subjected. In the superior incisive arch, the posterior borders of the corner teeth rarely commence to be worn. The profile of the incisives shows a regular one-half circle, convex from above to below.

During this period, besides the causes already referred to which produce hasty or tardy eruption of the permanent teeth, other influences may act. Traeger, veterinarian at Doehlen, noticed that gestation in the young mare delayed the eruption of the permanent teeth; he also observed that continuous pregnancies diminished the wearing of the teeth. During this period the tusks may make their appearance, or they may be delayed until after all of the incisors are in place. In cases of doubt, a further examination should be made as to the condition of the molars. By reference to the table of the eruption of these teeth it will be seen that the first permanent molar appears between the thirtieth and thirty-second months, the second at about three years, and the third at four to five years. The same rule as given for the second period applies here also, and a close comparison should be made of the comparative wearing of the pincher, intermediate, and corner teeth, as the first or second pair may be advanced in use and not correspond to the freshness of the delayed later teeth.

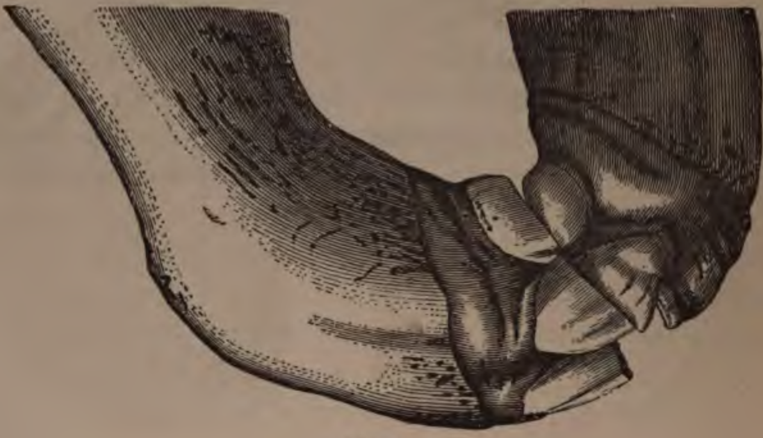


FIG. 65.

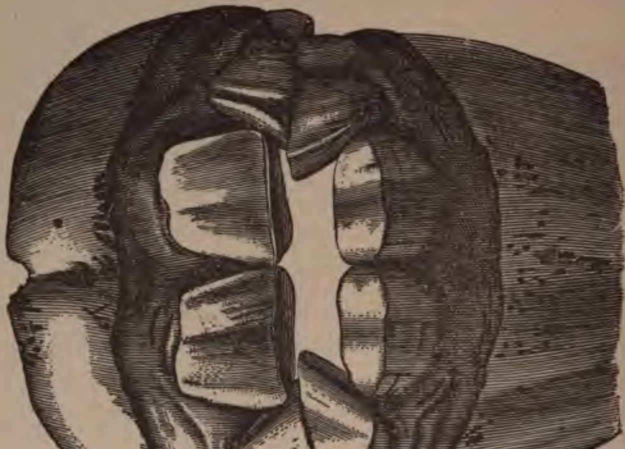


FIG. 66.

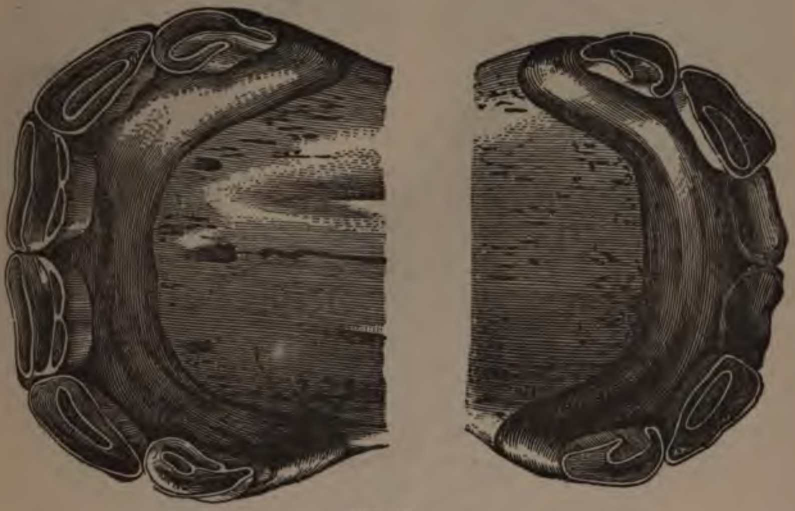


FIG. 67.

Rising Three Years (Figs. 65, 66, 67).—From in front, in the upper jaw, the two permanent pincher teeth are seen not yet opposite to the level of the intermediate deciduous teeth; below, the adult pinchers are just coming through the gum, showing a small portion of their anterior face. In profile, the intermediate teeth are very much worn, and the constriction on their neck is pushed out beyond their gums; the corner teeth are much shortened; the dental table shows slight wear of the superior pinchers, which has been produced by the eruption of these teeth before the inferior temporary pinchers had fallen out, and, consequently, they have worn against the latter. The intermediate teeth are completely leveled; the corner teeth are much used.

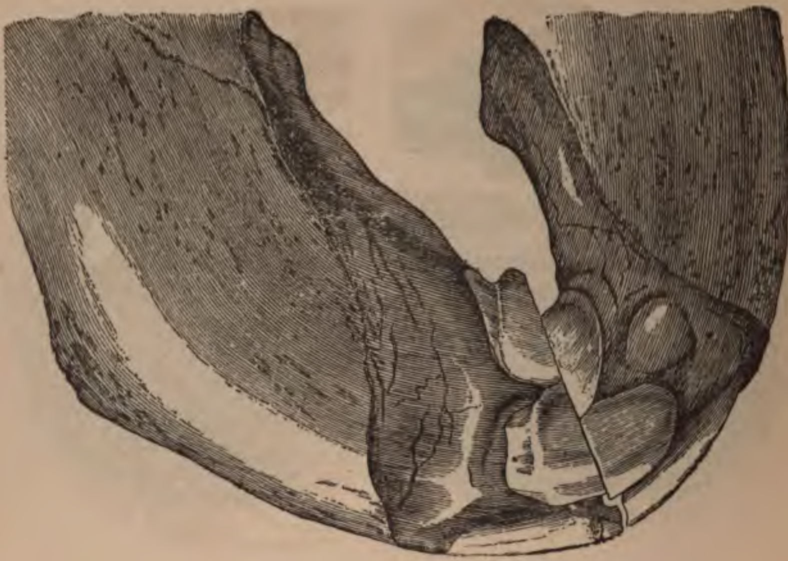


FIG. 68.

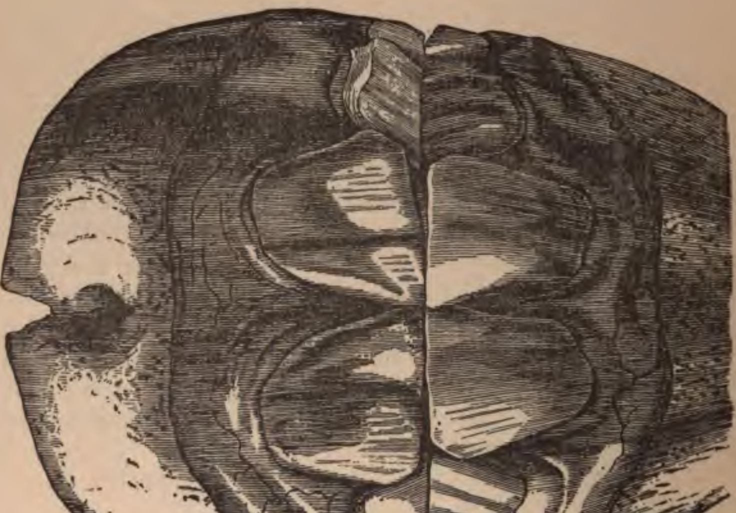


FIG. 69.

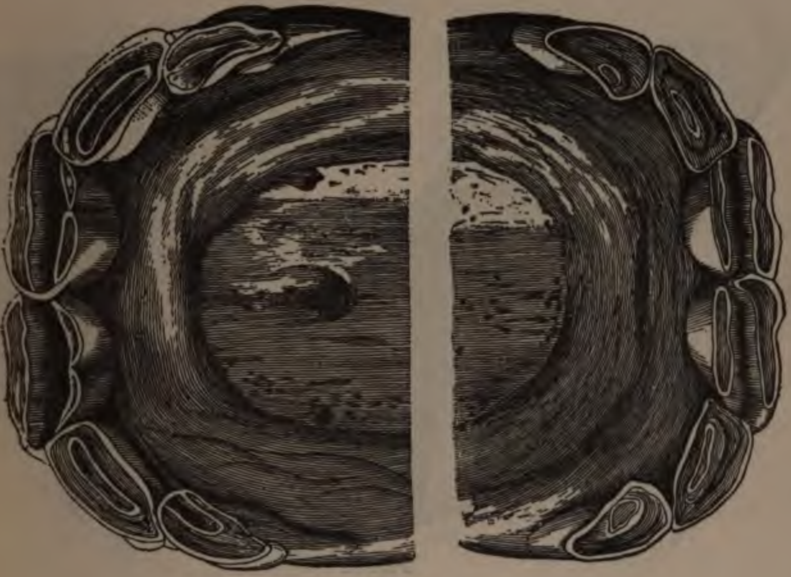


FIG. 70.

Three Years Off (Figs. 68, 69, 70).—From in front the four permanent pincher teeth are seen, much larger and stronger than the neighboring teeth. The anterior borders of the superior pinchers are oblique, and their external borders are not yet in contact with the corresponding part of the inferior teeth. In profile, the intermediate teeth are seen much used; the corner teeth are short, and show the constriction at their neck. The tables are worn off level. Between the corner and the intermediate teeth on the left is seen the protrusion of gum made by the permanent intermediate tooth which is shortly to appear. The dental tables of the inferior intermediate teeth are very much worn, the superior teeth somewhat less so. The inferior corner teeth are entirely leveled. In this mouth the tables of the inferior pincher teeth are the most worn, as these teeth came out before the superior ones did.

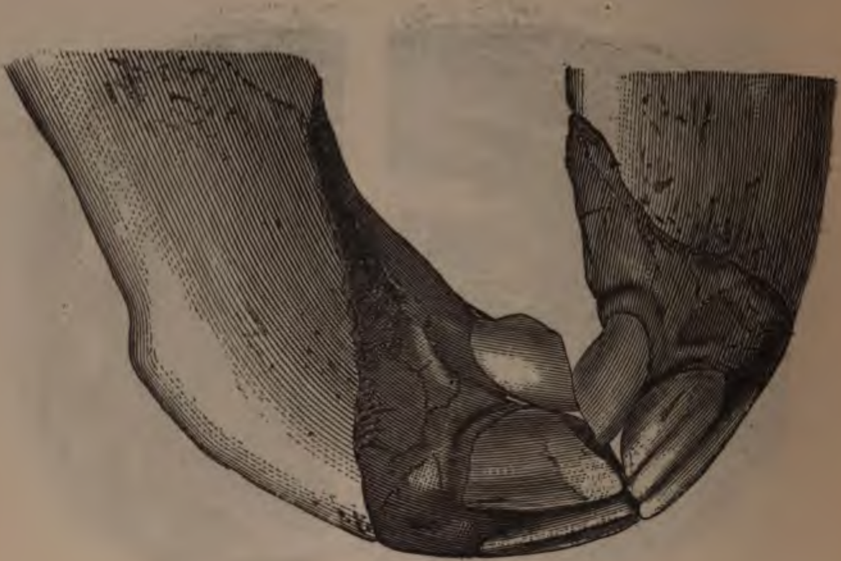


FIG. 71.

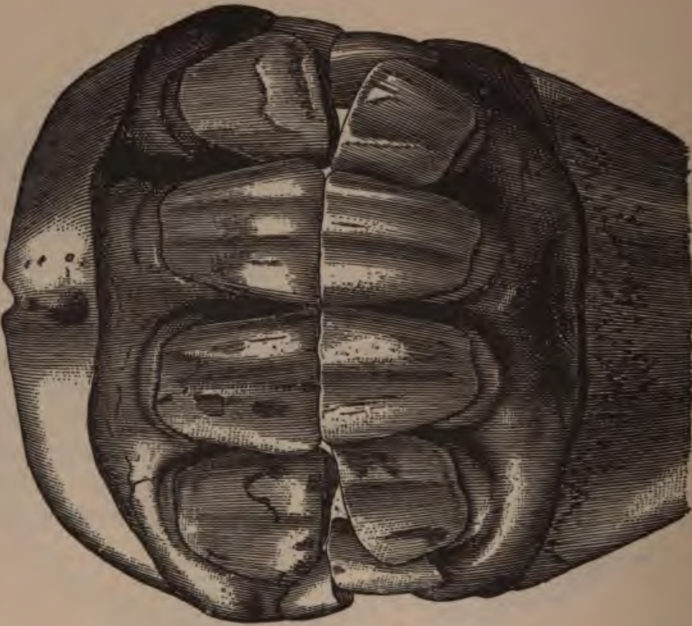


FIG. 72.

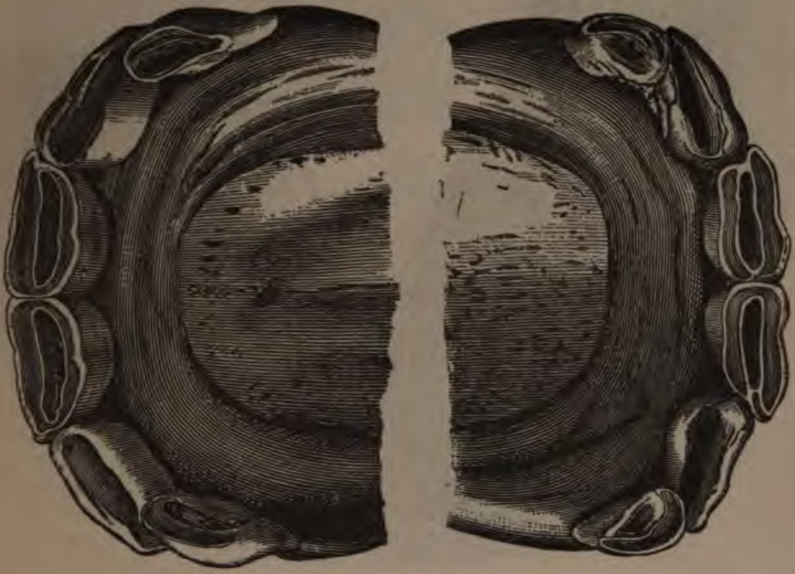


FIG. 73.

Rising Four Years (Figs. 71, 72, 73).—From in front are seen the eight adult incisors; the pinchers in contact with the opposite ones, and intermediate teeth not yet out to the level of the pinchers. In profile, this is also seen in this mouth. The corner teeth are very much worn; the tables of the pinchers are considerably worn, making almost a complete separation of the central, or cup, enamel from the peripheral enamel. This advanced wear of the pincher teeth is not in direct harmony with the amount of use of the corner teeth.

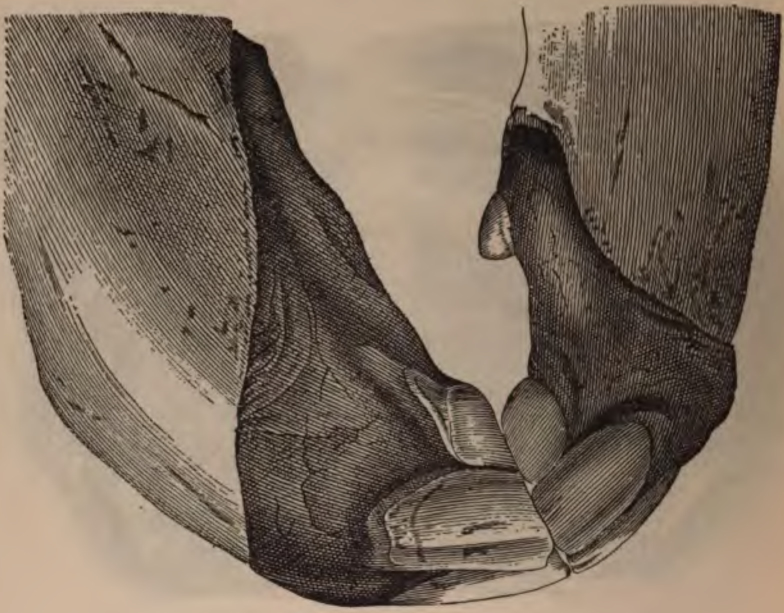


FIG. 74.

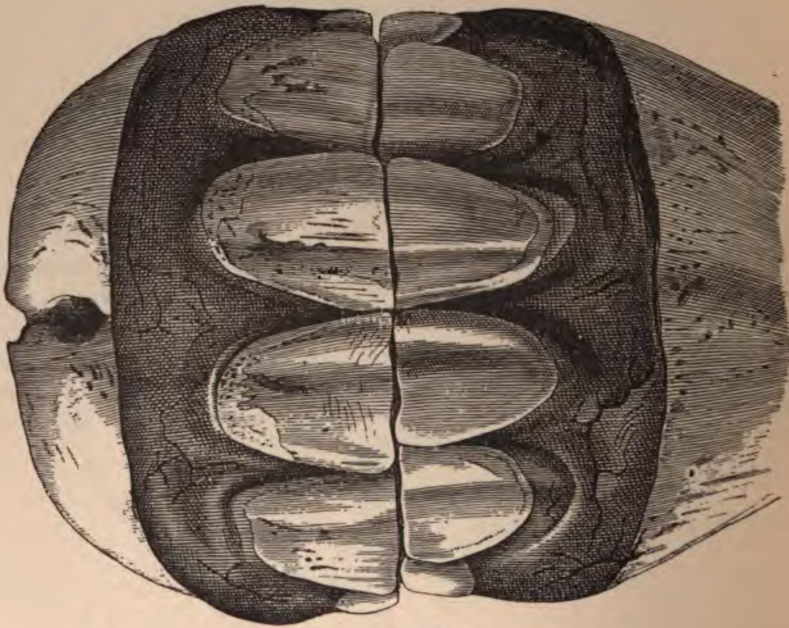


FIG. 75.

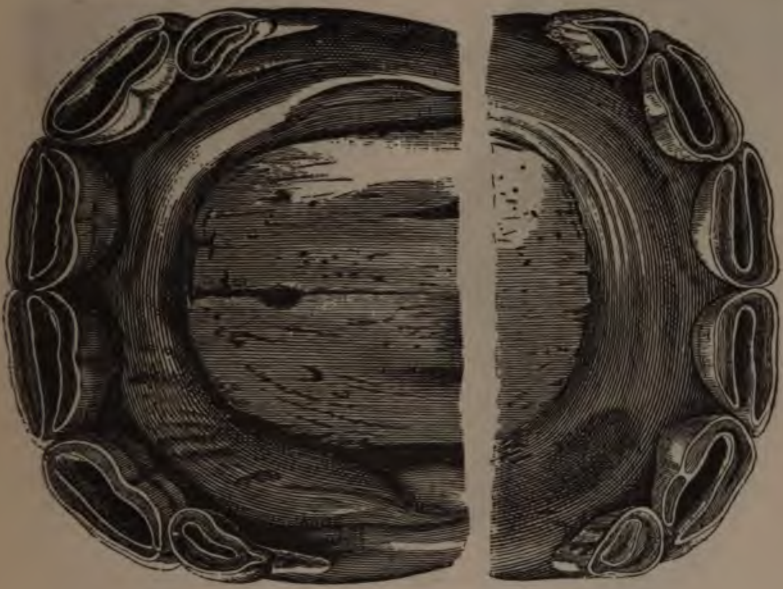


FIG. 76.

Four Years (Figs. 74, 75, 76).—From in front the four superior permanent teeth are seen in contact with the inferior teeth. The jaw has attained such a width that the corner teeth are almost hidden. In profile, the latter are seen to be very small. The superior ones have commenced to be pushed out from the jaw. In the lower jaw are seen the tush teeth. The tables of the intermediate teeth are much worn, especially in the upper jaw, in which the eruption took place first. The central enamel is only separated in the superior left-hand teeth; the inferior corner teeth are almost leveled, the superior ones completely so. The latter are being pushed out, and show their roots.

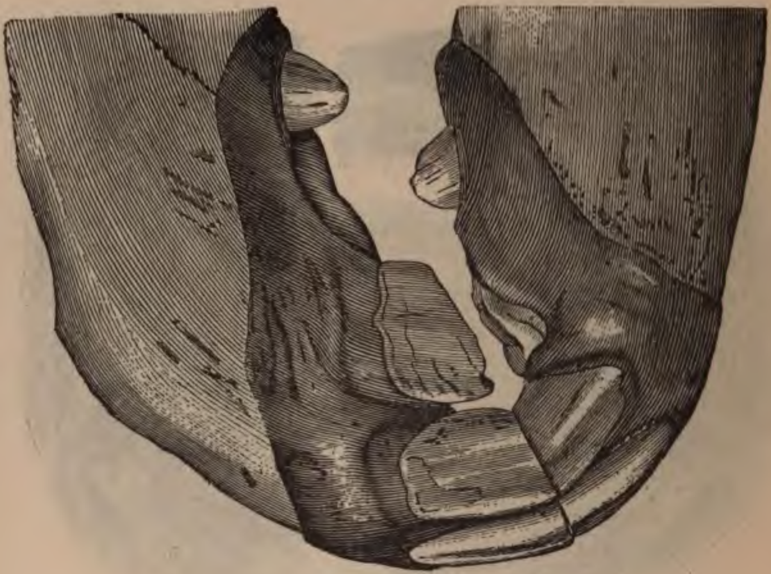


FIG. 77.

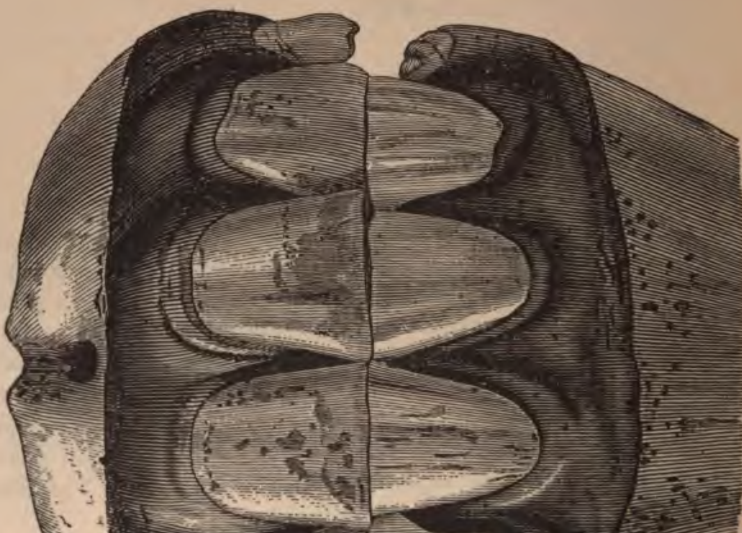


FIG. 78.

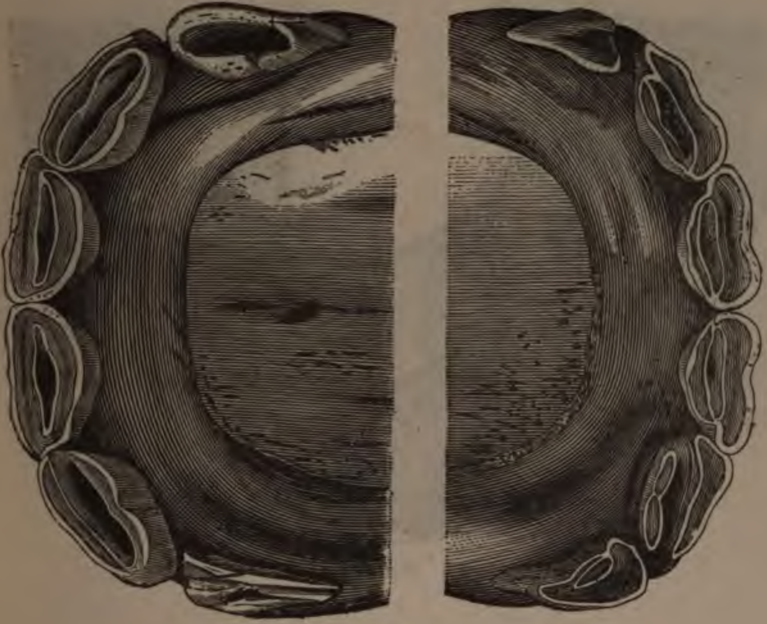


FIG. 79.

Four Years Off (Figs. 77, 78, 79).—In front the intermediate permanent teeth are seen in contact with each other; the inferior and superior left-hand permanent corner teeth have appeared. In profile, it is seen that these teeth have not been completely pushed through the gums. The tush teeth have appeared. The right-hand superior milk-tooth is ready to fall out; nothing remains but its roots. The inferior tooth on the same side is leveled, but still firmly imbedded in the jaw. The superior intermediate teeth, which preceded the eruption of the inferior teeth, show considerable wear. The cups have formed in the pincher teeth.

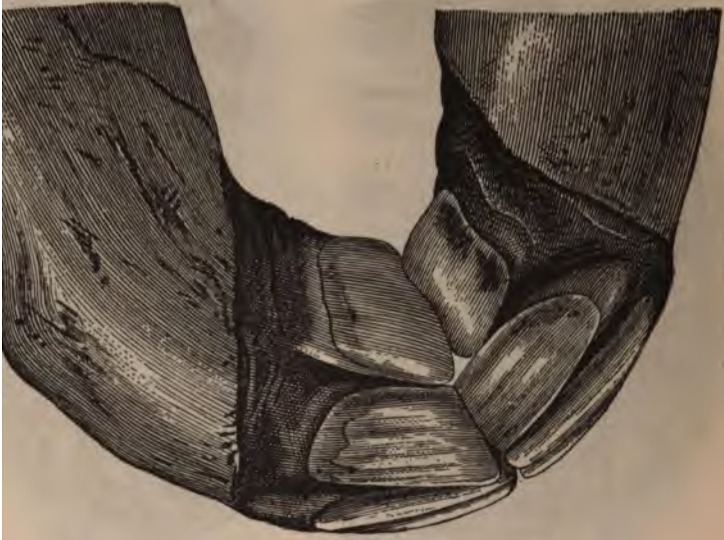


FIG. 80.

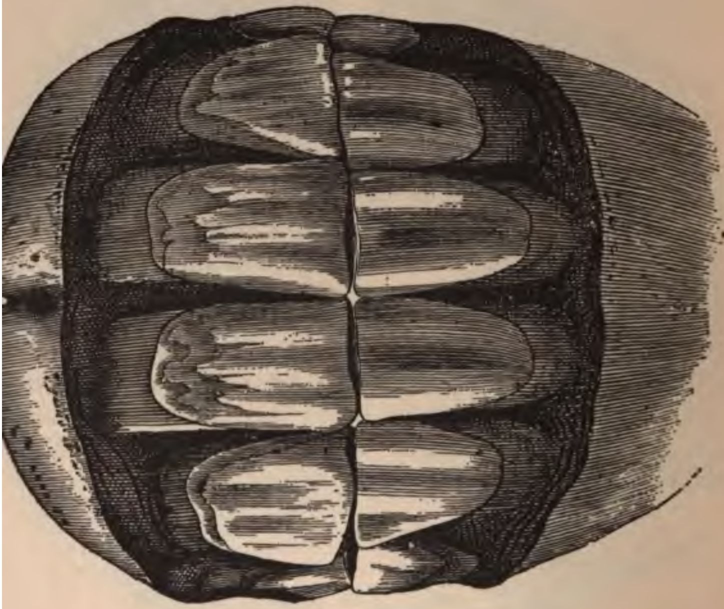


FIG. 81.

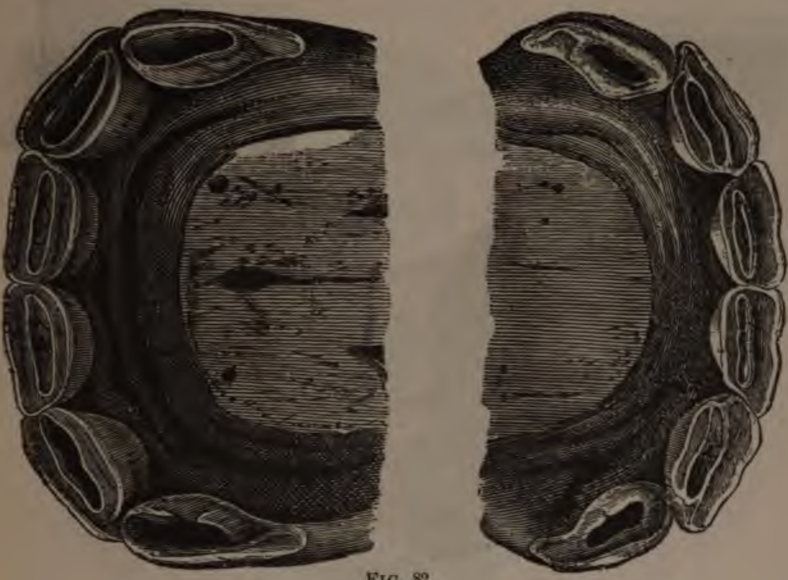


FIG. 82.

Rising Five Years (Figs. 80, 81, 82).—The four corner temporary teeth have been replaced by the permanent teeth, but these are not on a level with the intermediate and are entirely virgin. The tables of the other teeth show a more decided use than those in the last figures. Above, the cups are formed in both the pincher and intermediate teeth; the cups are nearly formed in the inferior intermediate teeth.

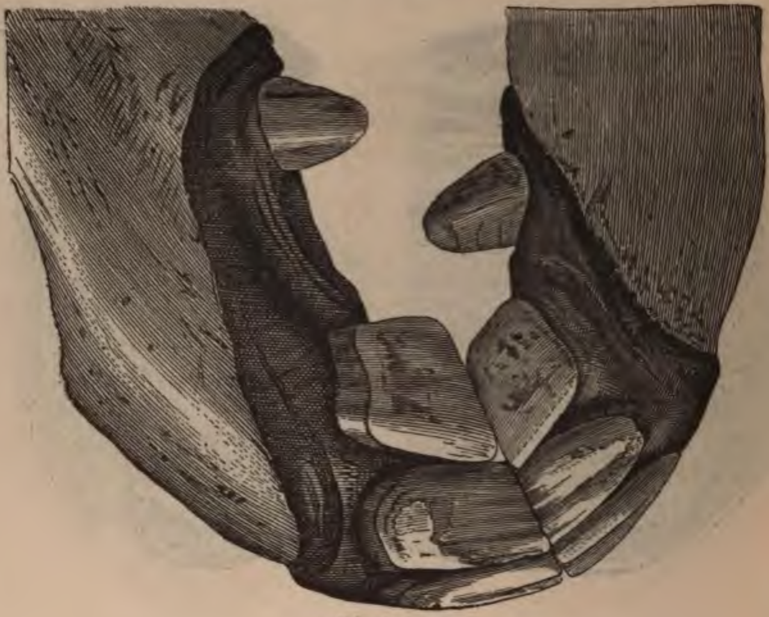


FIG. 83.

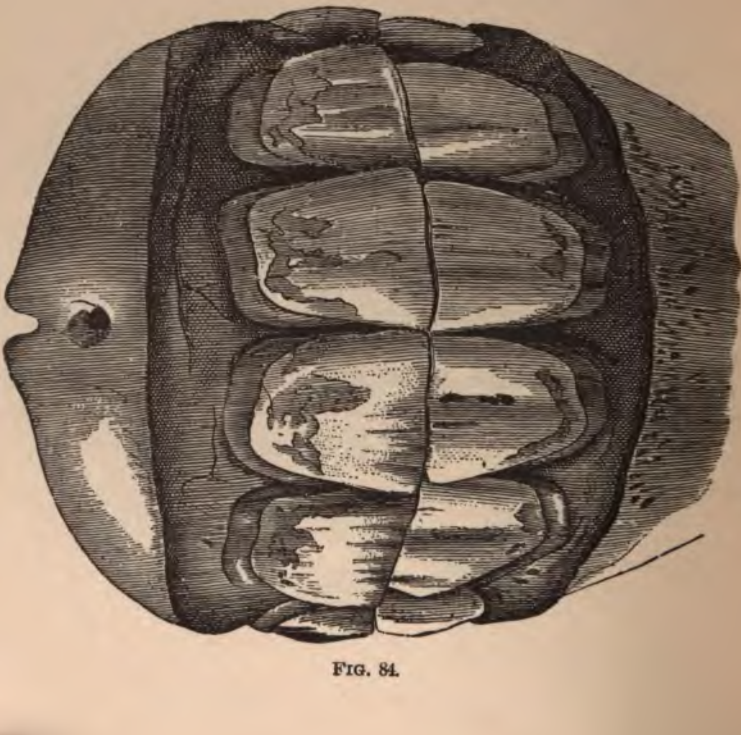


FIG. 84.

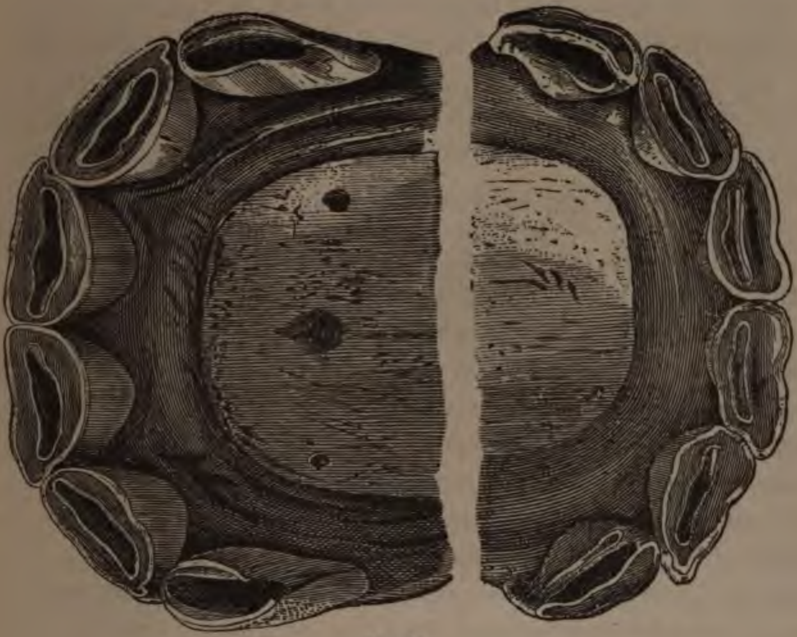


FIG. 85.

Five Years (Figs. 83, 84, 85).—The mouth is entirely made; all of the permanent teeth have reached the same level in both jaws. The jaws are convex in both directions; the tush teeth have completed their eruption. The corner teeth have commenced to wear on their anterior border; the pincher teeth are leveled, but the cups are still elongated from side to side and are very narrow; they commence to approach to the posterior border of the teeth. This form of cup indicates that in these teeth the cups are very shallow. The incisive arches form a regular half-circle.

FOURTH PERIOD.

LEVELING OF THE PERMANENT INCISORS.

DURING this period the signs furnished by the dental apparatus become more difficult to recognize, and the determination of the exact age is less precise than at an earlier period. The points to be examined from six years are, first, the wearing of the corner teeth, the form of the transverse diameters of the teeth, the position of the central enamel on the surface of the table, and the general outline of the incisive arch.

At six years, after the complete leveling of the teeth, the tables of the pinchers commence to become oval in shape. The posterior border of the corner teeth has become worn and the cup is completely separated from the peripheral enamel. The cement disappears from the anterior face of the pinchers, so that they become whiter in color. Very frequently at this age the notch commences to show on the outer border of the superior corner teeth.

At seven years, all of the teeth are denuded of cement on their outer faces and are much whiter in color. The inferior corner tooth, which is narrower from in front to behind than the superior, wears only the anterior portion of the latter and makes distinct, in profile, the notch which we have just seen often commences at six. The pincher teeth become narrower from side to side, and the oval of the posterior border shows a projection backward; the intermediate teeth become oval, and, in both, the cups become decidedly narrower and are found nearer the posterior border of the teeth. In profile, the incidence of the jaws has altered from the convex arch of six years and tends to assume the form of an ogive.

At eight years, the incisors commence to turn from a white to a yellowish white. The arches are narrower from side to side, the obliquity of the teeth is greater, and, as the inferior corner teeth now commence to wear by their posterior borders, their tables become elongated and correspond to the tables of the superior corner teeth in size, so that the notches of the latter become less marked. The interspaces between the teeth become more marked and the gum commences to retract from the crowns, giving a square cut-off appearance. The tables become more convex on their posterior borders, and the cups, which continually approach the posterior borders of the teeth, in the pincher teeth become convex behind. In front of them, half-way to the anterior border of the teeth, a transversely elongated dark-yellow line appears. This is the *dental star*, brought into view by the uncovering of the calcified dental pulp. If the structure and formation of the incisive teeth are remembered, the exact value of the dental star will be better appreciated. In the virgin tooth the upper extremity is hollowed by the cup, and the dental pulp occupies the space between the anterior face of the cup and the anterior face of the tooth itself. But we have seen that the cup, pointing downward, also inclines toward the posterior border of the tooth. At eight years the cup is at the division of the posterior and middle thirds of the table of the tooth, and the dental pulp is found on the line between the middle and anterior thirds. The transverse extent of the dental star is much less in the intermediate and corner teeth than it is in the pincher teeth.

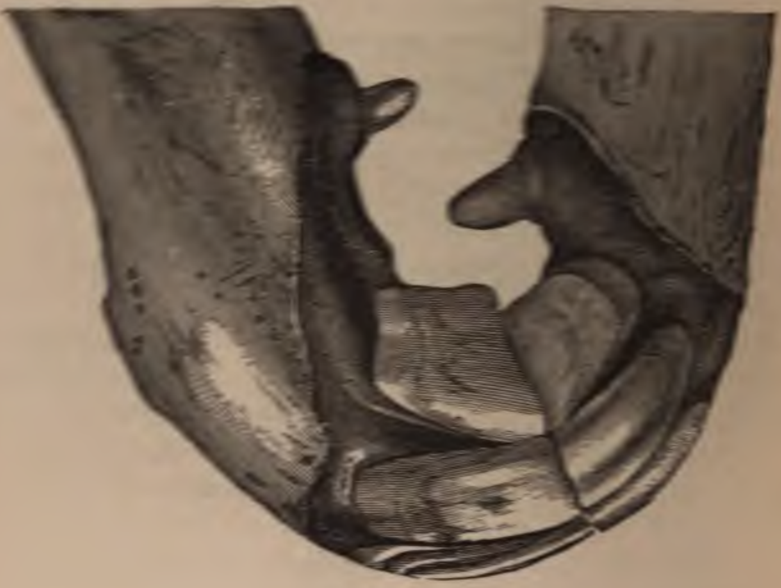


FIG. 86.

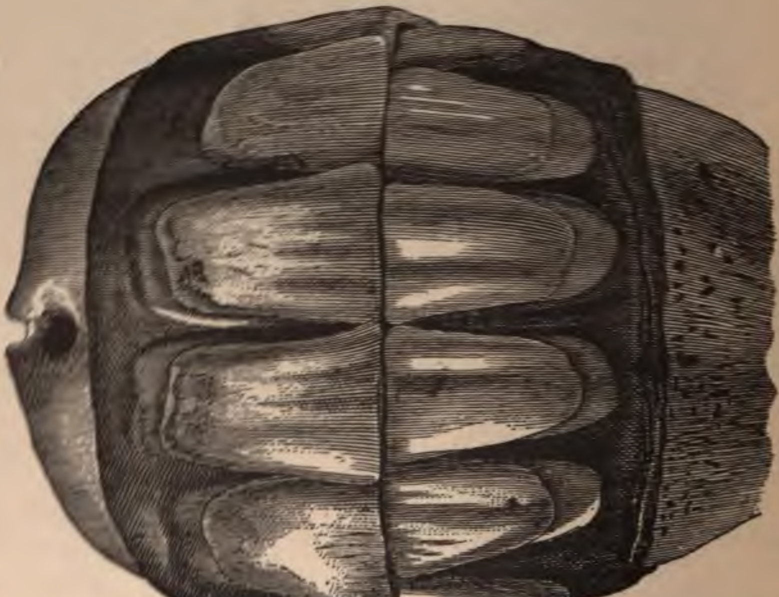


FIG. 87.

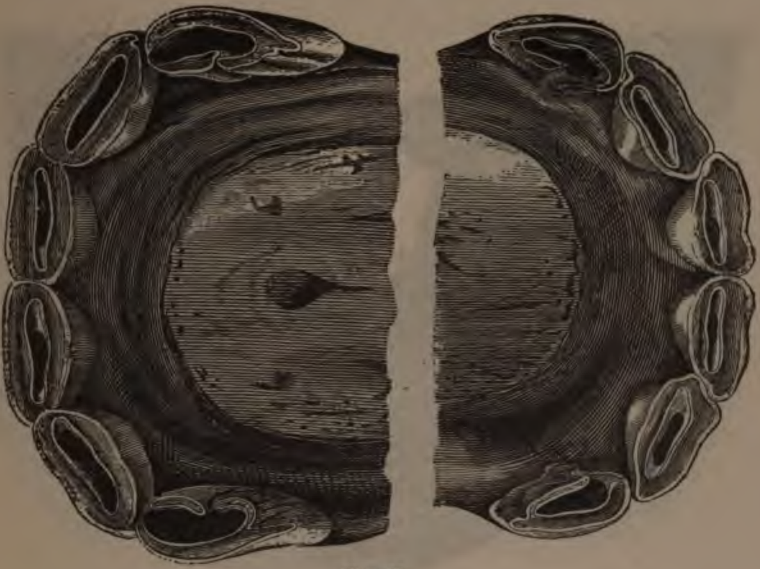


FIG. 88.

Six Years (Figs. 86, 87, 88).—In front, the teeth appear much as they were at five years of age. In profile, we see in this animal a more tardy eruption of the tush teeth, which are not yet quite free from the gums, and are, therefore, of little value as regards the age. The tables furnish a most accurate guide; the posterior border of both inferior and superior corner teeth are worn; the pincher teeth are leveled and their tables tend to an oval form. It is seen, however, that the inferior cups are thicker at their anterior borders,—due to a small portion of the surface enamel still remaining. The cups are narrower from side to side than at five years, and somewhat closer to the posterior border of the table; the same appears on the intermediate teeth. It will be noticed that the cups of the superior corner teeth have fissures on their posterior borders, which is of frequent occurrence and does not interfere with judging the amount of work which they have performed.

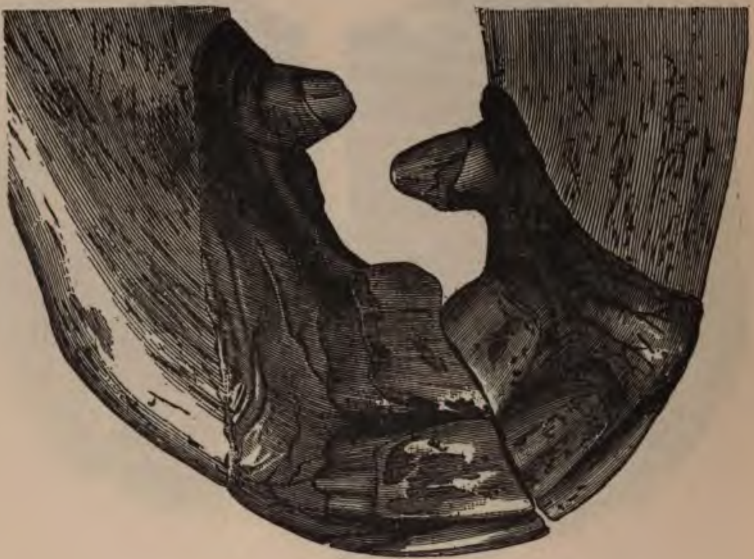


FIG. 89.

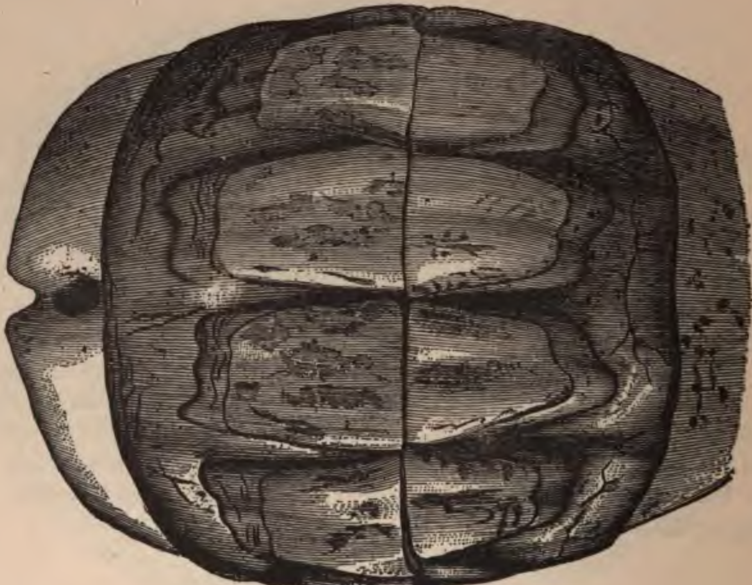


FIG. 90.

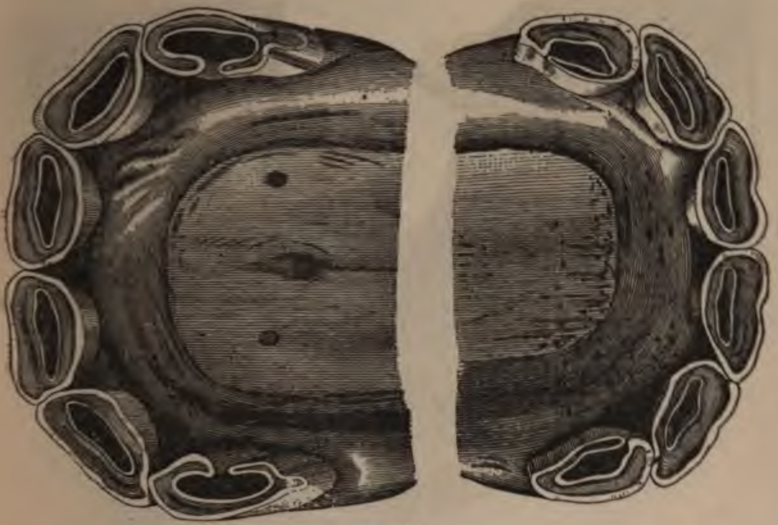


FIG. 91.

Seven Years (Figs. 89, 90, 91).—There is nothing special to be seen in front except that the teeth are whiter,—due to the disappearance of the cement, which has been worn from the surface of the enamel. In profile it is seen that the table of the inferior corner tooth is narrower than that of the superior from the front to behind, so that a notch is formed on the posterior corner of the latter. The incident of the tooth is less perpendicular than at six years. The cups of the tables of the intermediate teeth are wider from in front to behind and narrower from side to side. In the corner teeth the wearing surface is larger and the cups are smaller. The pincher teeth are oval and the intermediate teeth commence to become so. In this mouth, again, the superior corner teeth are fissured on their posterior borders.

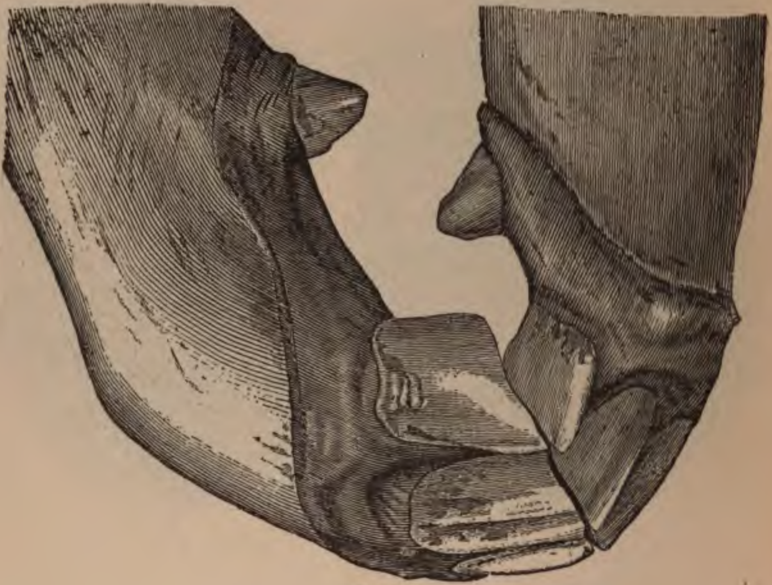


FIG. 92.

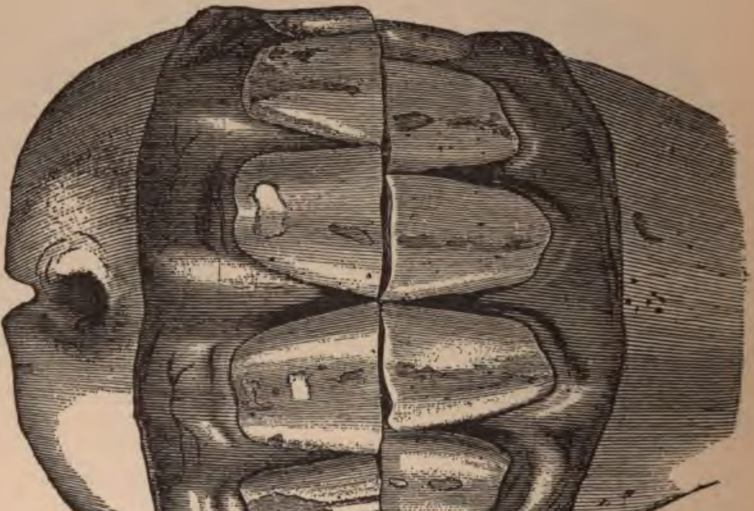


FIG. 93.

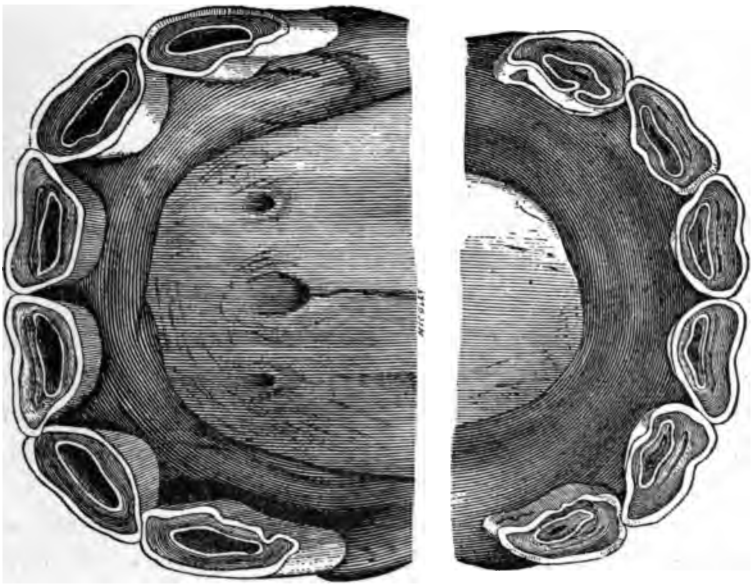


FIG. 94.

Eight Years (Figs. 92, 93, 94).—The direction of the incisors is decidedly changed; the inferior and superior arches are opposed obliquely; seen from in front, the teeth project at the line of apposition. In the profile this is more apparent, and the arch assumes more the form of an ogive. The incisive arches are still regular, but decidedly smaller than the earlier ages. All of the inferior tables are leveled; the pincher and intermediate teeth are oval, the corner teeth begin to become so. The cups commence to assume an angular form behind, and are narrow. The dental star has appeared in the pinchers and commences to show in the intermediate teeth, between the anterior border of the table and the corresponding part of the cup.

FIFTH PERIOD.

WEARING AWAY OF THE CROWNS.

After this time, which is commonly known as "past mark of mouth," commencing at nine years and extending to old age, the regularity of the wearing of the teeth and the certainty of the signs of age furnished by them become more variable. The uncertainty increases greatly after fifteen years, and a year or two later the estimation of age from the teeth can only be a conjecture, based upon experience and subject to error of one, two, or even several years, which becomes greater the older the animal is.

The changes of this period are: The successive alteration in shape of the tables of the teeth; the position of the cups in the incisors of both jaws; the form and location of the dental stars in the tables; the obliquity or degree of incidence in the incisive arches; the convergence of the crowns and the narrowness of the jaw holding the roots; the thickness of the enamel on the anterior and posterior faces of the teeth; the appearance of the cement around the roots; and, the shape of the bones of the face and jaw.

At nine years, the pinchers are round; their cups are triangular and their dental stars are more distinct, but narrower. The intermediate teeth commence to become round and the corners oval; the superior pinchers are often leveled; the notches on the superior corners often disappear.

At ten years, the tables of the pinchers are decidedly round; the cups are very small and distinctly triangular. The intermediate teeth assume the shape of the pinchers the previous year. The dental star is nearly in the middle of the table.

At eleven years, the corner teeth are rounded. The cups are only small spots near the posterior borders of the tables; the dental stars are in the middle of the tables. The inferior corners are as large at the gums as at their free extremities, and notches re-appear on the superior corner teeth.

At twelve years, all of the teeth are round; only a trace of the cups remains in the inferior ones. The superior corners are leveled. Both incisive arches are much narrower and the tongue shows over their borders. The inferior border of the jaw-bone becomes sharp, and a flattening of the sides of the face, over the roots of the superior molars, is seen. The incidence of the incisive arches increases, especially if the teeth are unusually long.

At thirteen years, the signs of twelve years are more marked. The notch on the superior corner teeth is greater. The cups usually disappear from the inferior incisors at this age, and the superior pinchers become round.

At fourteen years, the pinchers become triangular; the incisive arch is depressed in front and becomes decidedly narrower.

At fifteen years, the intermediate teeth commence to become triangular. The dental star is round in all the lower teeth and is dark and distinct. The cups of the upper teeth are smaller in size.

At sixteen years, the intermediate teeth are triangular.

At seventeen years, all of the lower teeth are triangular, and the dental stars are small and round. The cups of the upper corner teeth have disappeared and those of the others are round.

After nineteen, the cups have usually all disappeared, the teeth approach a line parallel to the bones of the jaw, which is especially marked in the lower jaw, and the arches are flattened from side to side. The lower teeth may be worn almost to the gums, and deposits of cement around their roots may develop to supply a wearing surface.

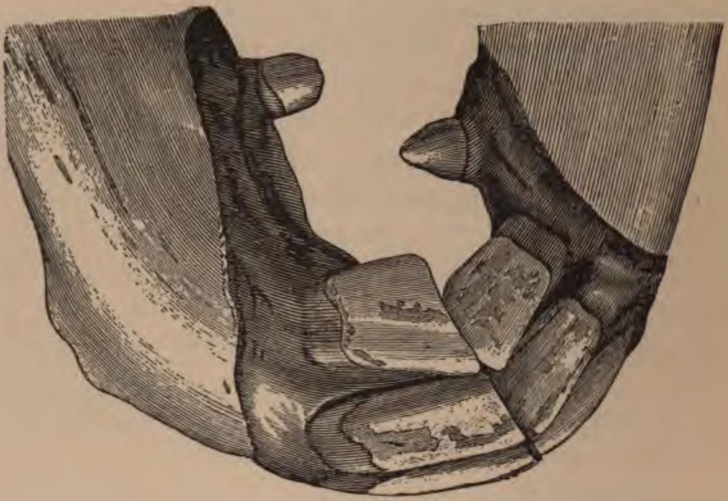


FIG. 95.

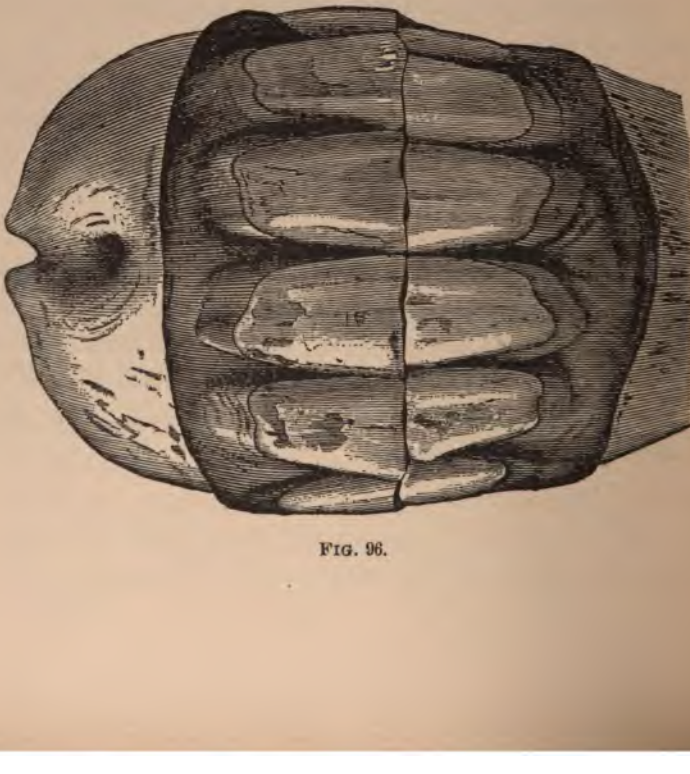


FIG. 96.

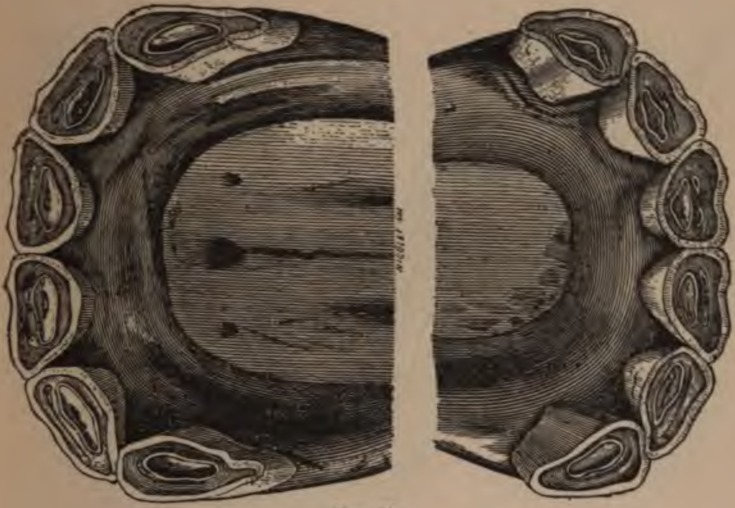


FIG. 97.

Nine Years (Figs. 95, 96, 97).—There is no special change to be seen from in front or in profile, although ordinarily the teeth are more obliquely formed and less fresh-looking than at eight years of age. The notch on the superior corner has generally disappeared; the tables, however, at this age are characteristic; the pinchers are rounded and their cups have assumed a triangular form; the dental star is narrower and more distinct, and is nearly in the centre of the table; the intermediate teeth commence to become round, and the corner teeth are oval; the superior pincher teeth are sometimes leveled; the inferior incisive arch is narrower and depressed in the centre.

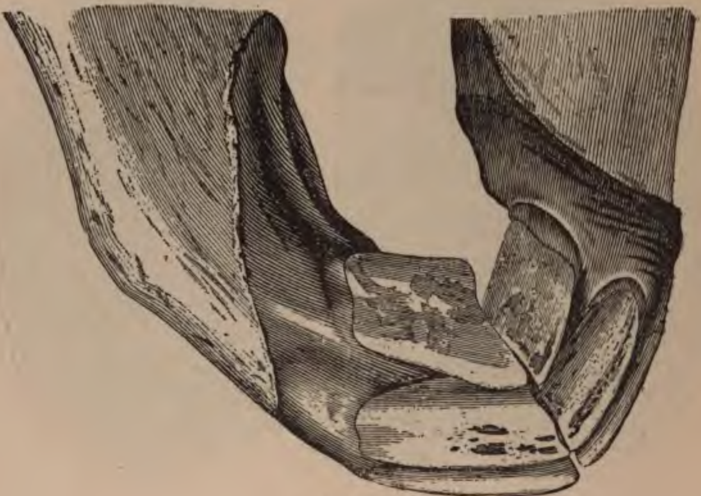


FIG. 98.

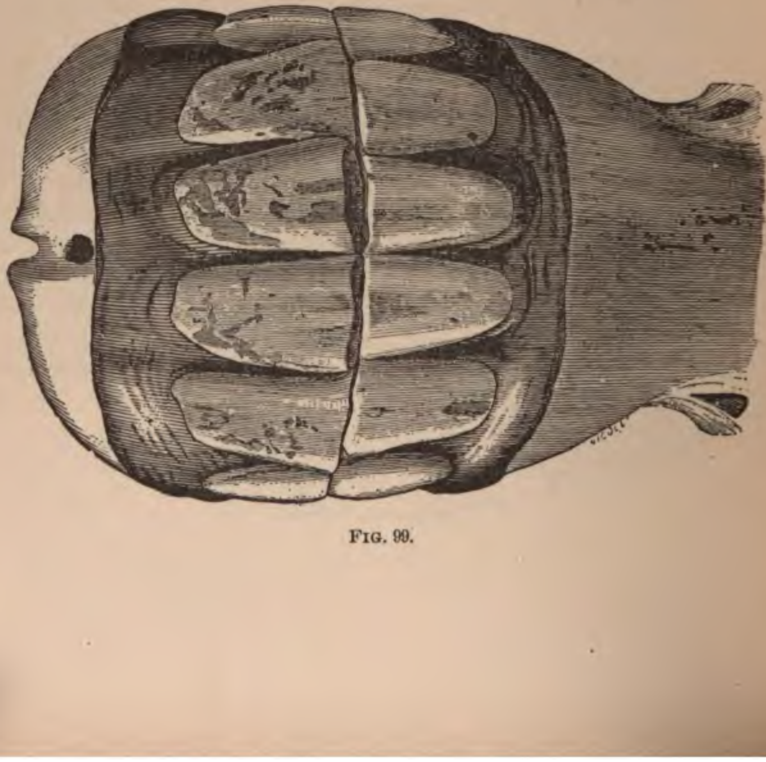


FIG. 99.

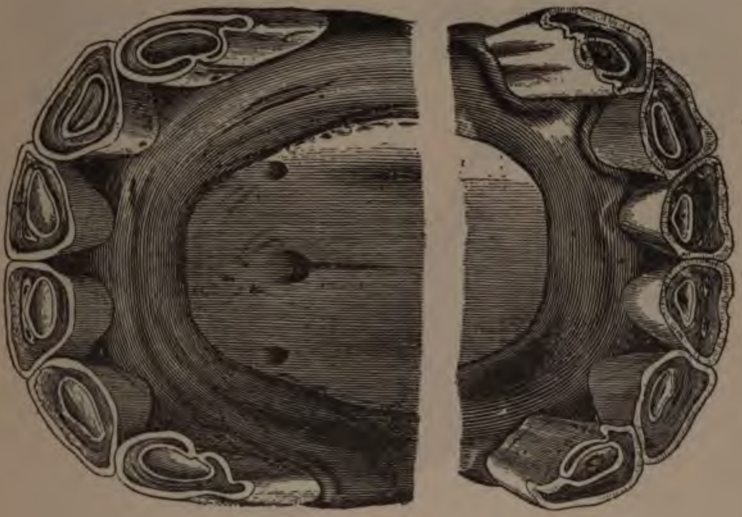


FIG. 100.

Ten Years (Figs. 98, 99, 100).—From the increased obliquity of the teeth the jaws become prominent in front, and at the ordinary height of the head the inferior incisors are hidden when looked at from in front. The ogive formed by the two sets of incisors, when looked at in profile, is more closed; the angle of the teeth increases, and a greater interspace is found between the intermediate and corner teeth. On the tables the inferior pinchers are seen to be more rounded than at nine years, and the cup is smaller and decidedly triangular; it is closer to the posterior border of the teeth. The dental star, still more apparent, is found about the centre of the teeth. The intermediate teeth are rounded and the corner teeth commence to assume this form. The example furnished by the plate shows deep fissures on the posterior border of the corner teeth. The incisive arch is flatter in the centre. In the plate showing the teeth from in front the superior pinchers are seen to be somewhat worn from cribbing.

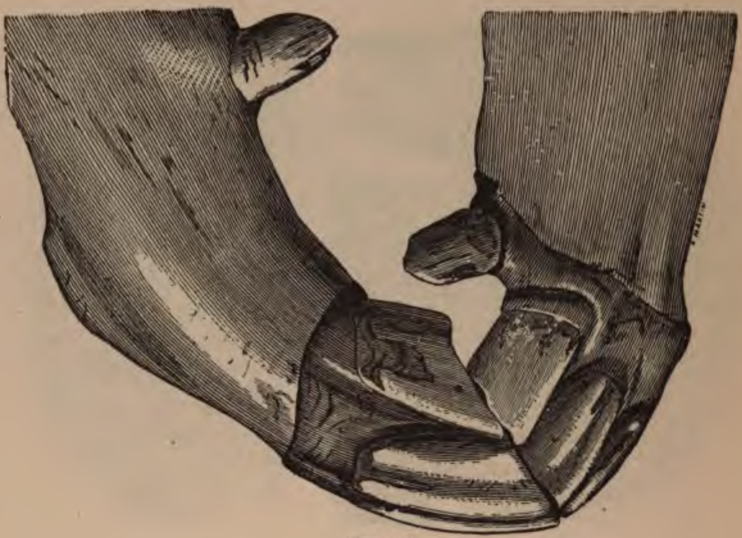


FIG. 101.

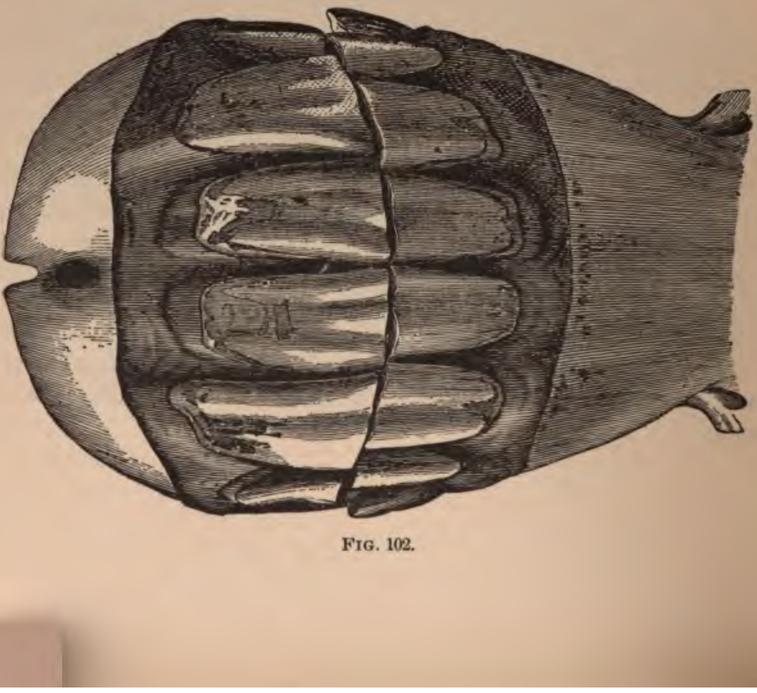


FIG. 102.

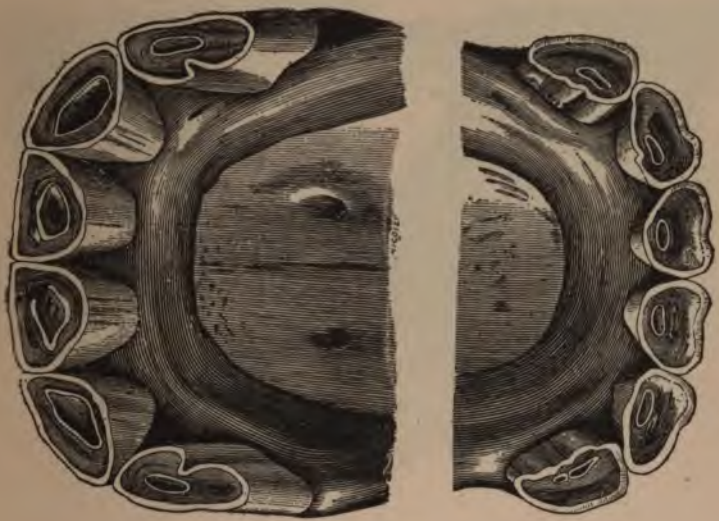


FIG. 103.

Eleven Years (Figs. 101, 102, 103).—The incidence of the jaws increases in obliquity so that the head of the horse must be raised to see both from in front. In profile, the superior corner tooth is decidedly more oblique than the intermediate one; the inferior is the same size at its free surface and its base, and its gum is square. The inferior tables are round on the intermediate and rounded on the corners. In the lower jaw the cups are diminished to little islands close to the posterior borders of the tables, and the dental stars are narrower from side to side and near the centre of the tables. In the upper jaw the cups of the corner teeth are elliptic and commence to disappear.

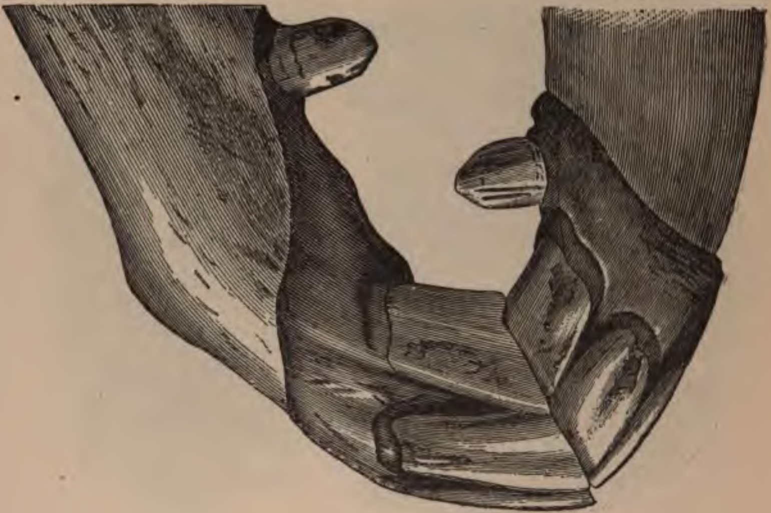


FIG. 104.

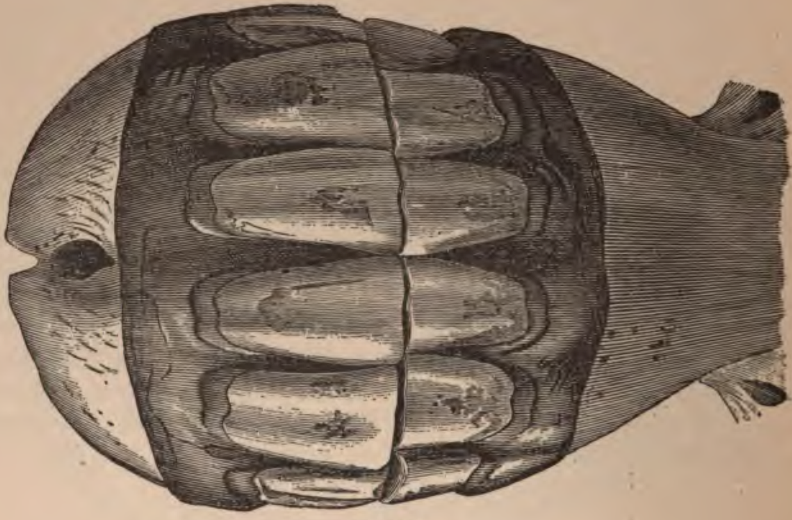


FIG. 105.

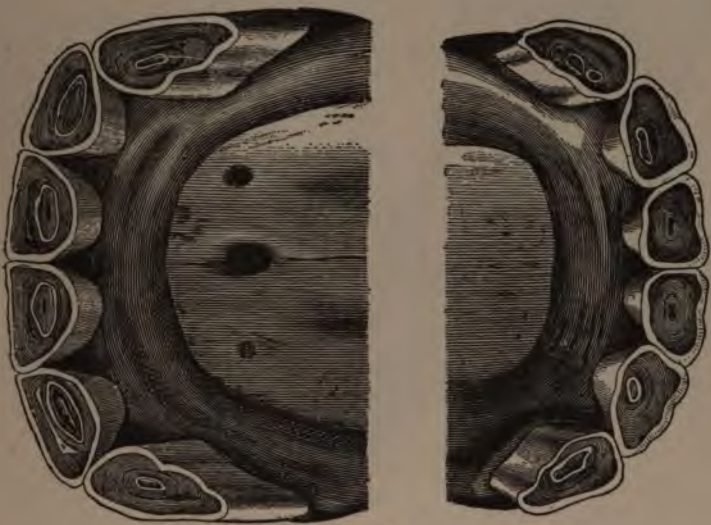


FIG. 106.

Twelve Years (Figs. 104, 105, 106).—The incidence of the jaws is still more oblique than at eleven years. In profile, the superior corner tooth is still more oblique; it has a notch on its posterior border, and it is separated farther from the intermediate. The inferior tables are round and nearly leveled, or only have traces of the cups. A yellow spot represents the dental star. The superior corner teeth are almost leveled. The incisive arches are narrower and less convex than at an earlier age.

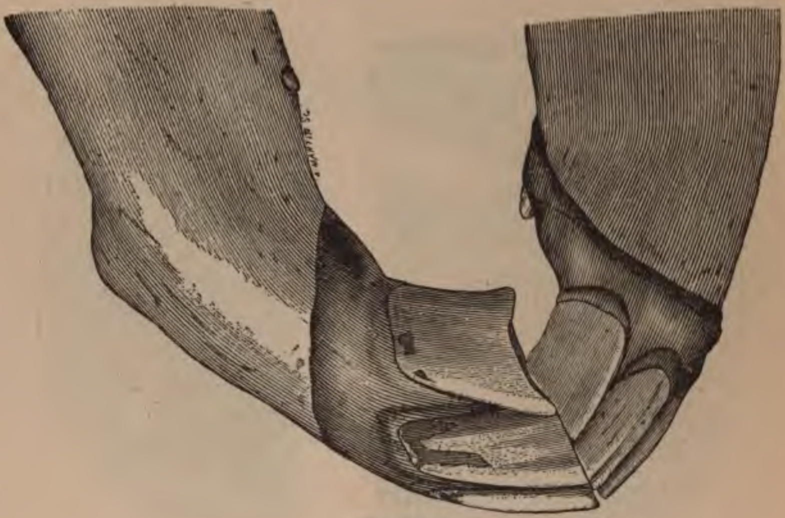


FIG. 107.

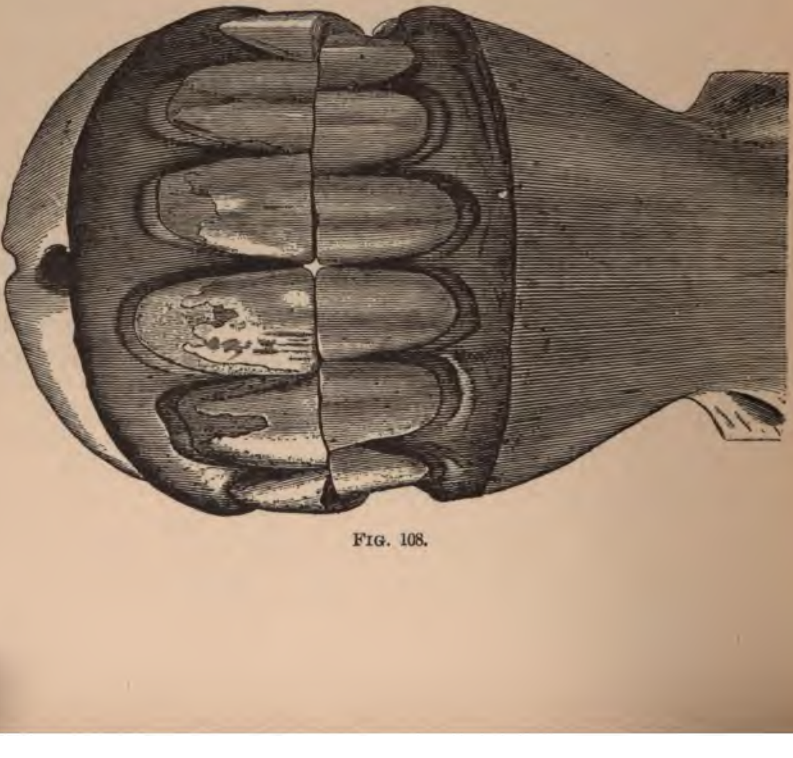


FIG. 108.

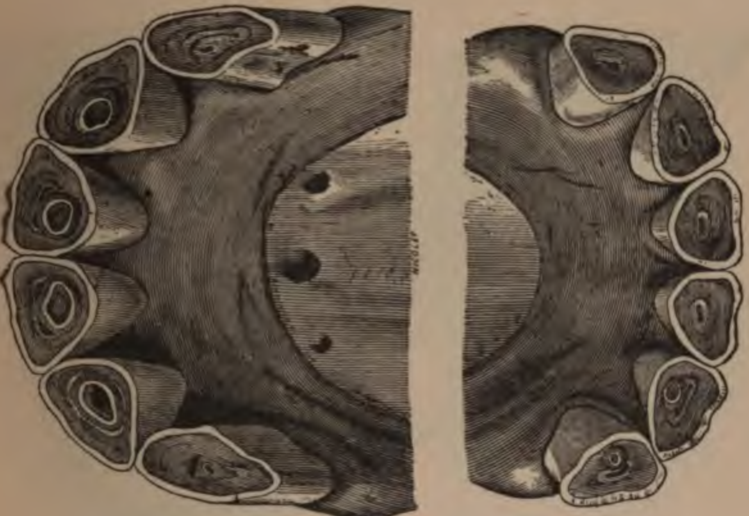
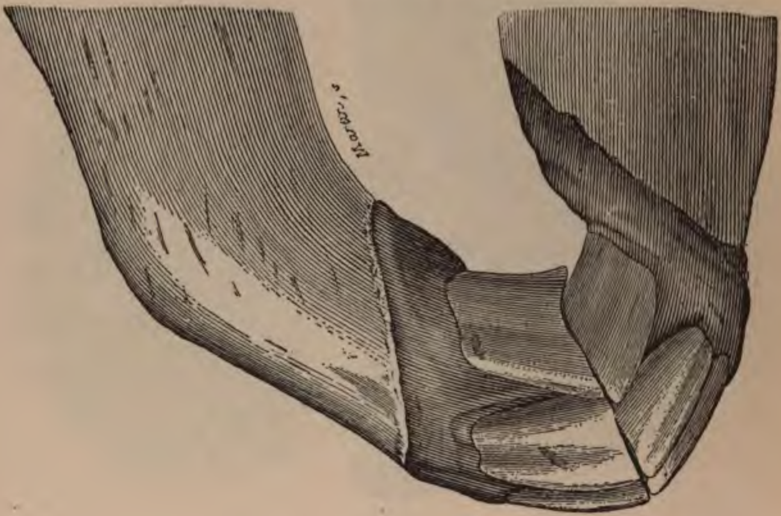


FIG. 109.

Thirteen Years (Figs. 107, 108, 109).—In front, the appearance is much the same as it is at twelve years. In profile, the notch of the superior corner tooth is larger; the inferior appears narrow, with its borders parallel. The plate, drawn from a mare's mouth, shows rudimentary tusk teeth. The inferior tables are round and generally leveled. The superior corner teeth are generally leveled. In the superior pinchers the cups are rounded.

FIG. 110.



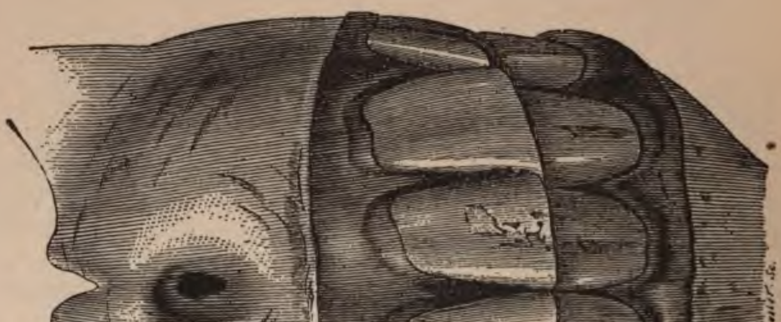


FIG. 111.

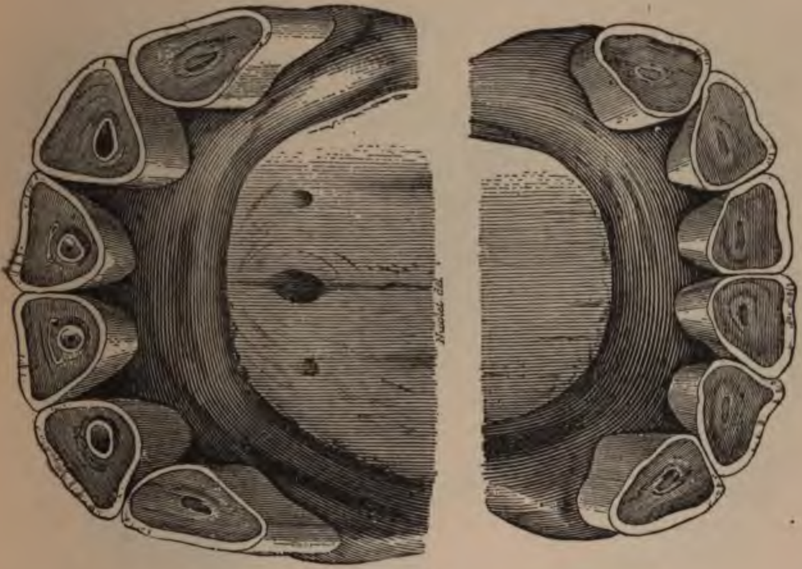
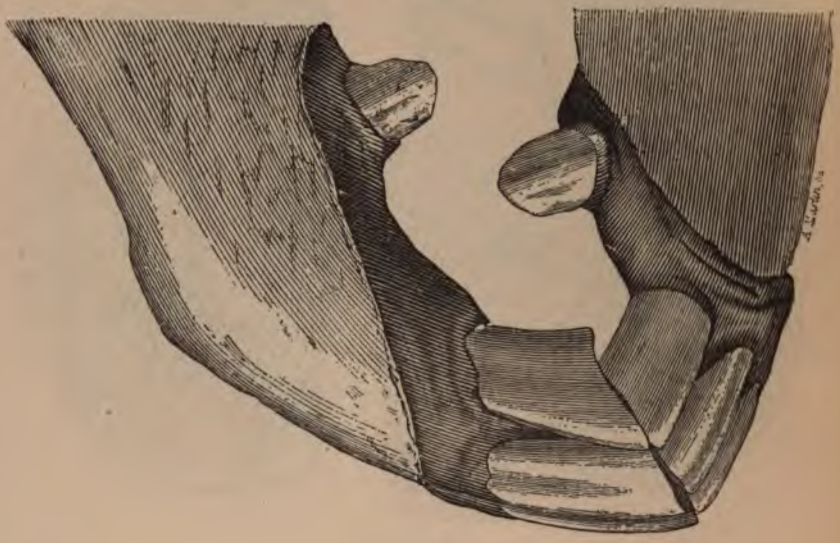


FIG. 112.

Fifteen Years (Figs. 110, 111, 112).—From in front the inferior teeth appear shorter than the superior, as the jaw has not been raised to the proper height; in profile, they are seen to be about the same length. The notch in the superior corner teeth continues. The inferior tables show, in their centre, a very decided, rounded dental star. The pinchers are nearly triangular in shape; the intermediate teeth begin to become so. The central enamel in the upper pinchers is much smaller than at thirteen years; the incisive arch is depressed in front and narrowed transversely. In this mouth the cups have disappeared from the upper corner teeth.

FIG. 113.



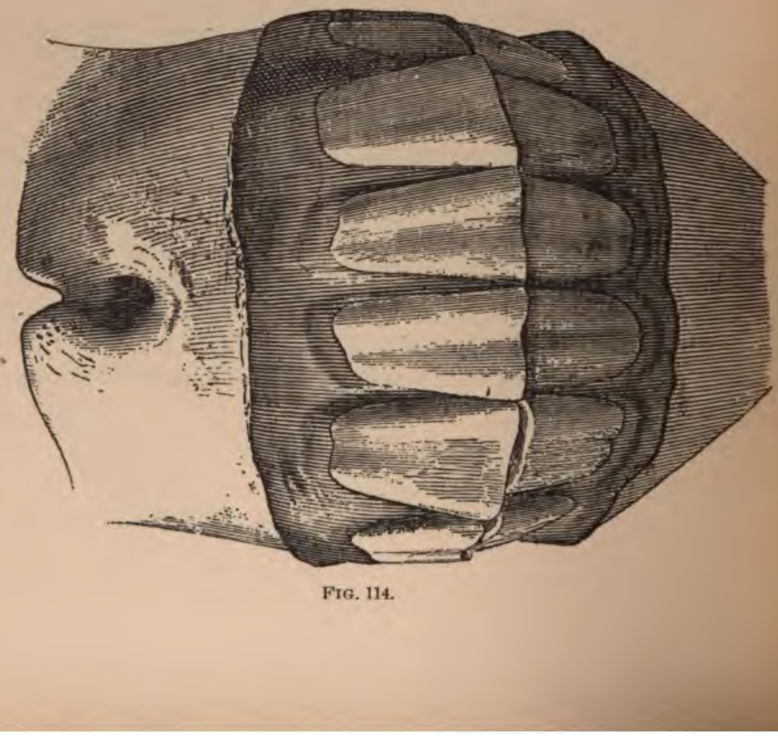


FIG. 114.

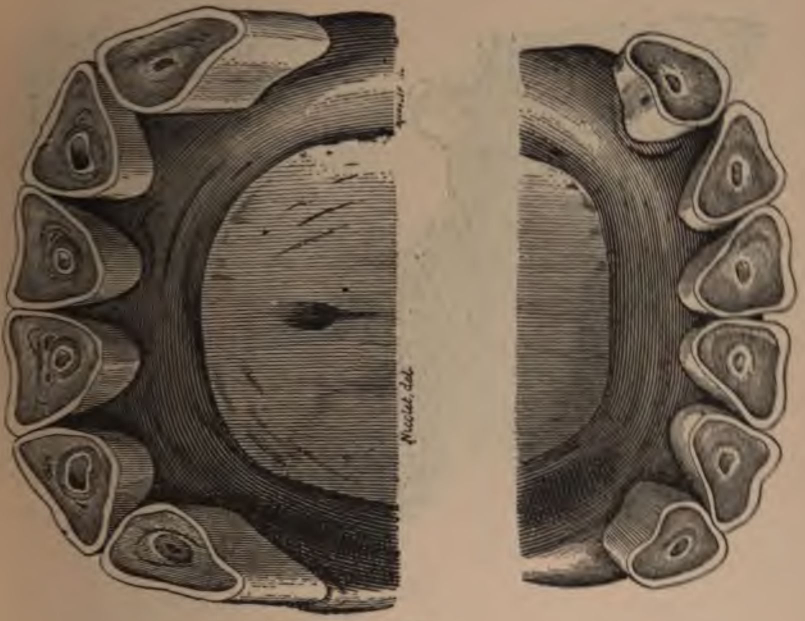


FIG. 115.

Seventeen Years (Figs. 113, 114, 115).—In front, the superior corner teeth incline toward the centre. The line of apposition of the teeth is very oblique on the horizontal line. To see the inferior teeth distinctly, the head must be well lifted. The tables of the inferior teeth are all triangular; the dental star is in the centre and distinctly round. The inferior incisive arch is narrow, only slightly convex, and the teeth appear more separated from each other than at any previous period; the pinchers especially are separated from each other in the median line. The tables of the superior teeth are triangular; the cups of the pinchers have nearly disappeared.

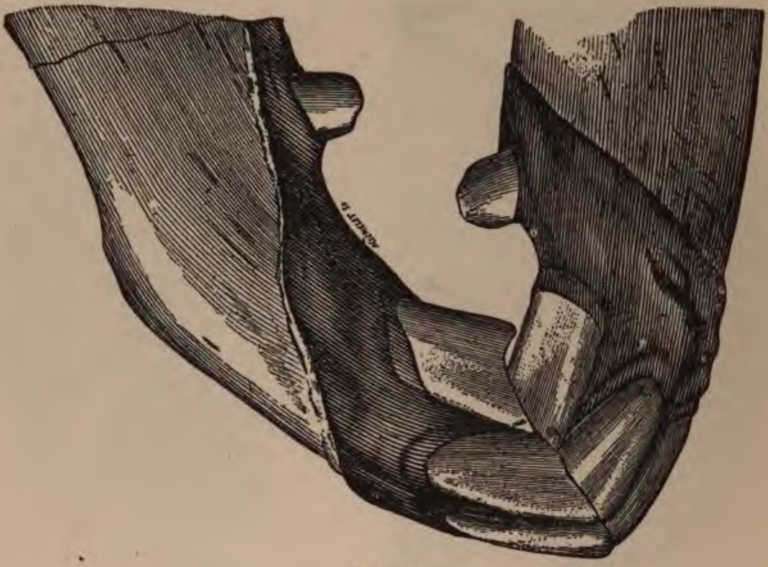


FIG. 116.

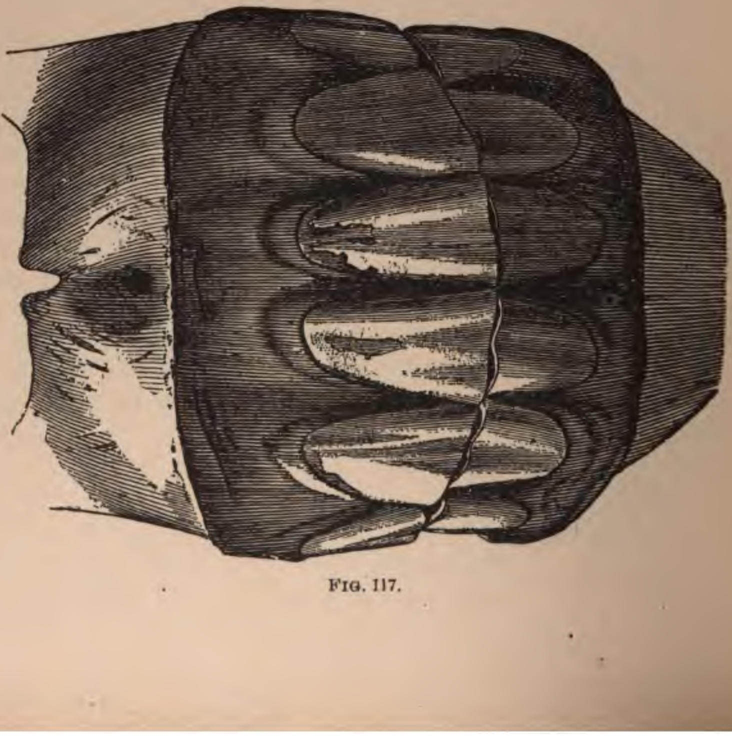


FIG. 117.

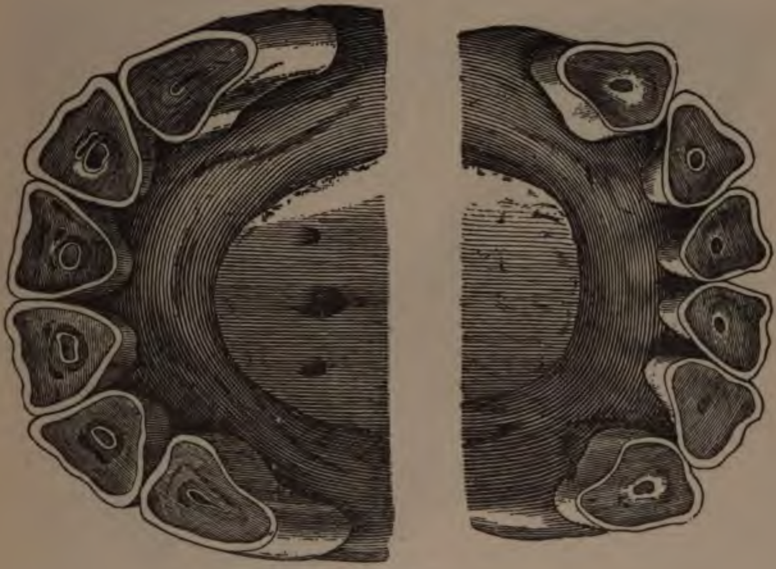


FIG. 118.

Nineteen Years (Figs. 116, 117, 118).—From in front the superior corner teeth point distinctly toward the median line; the intermediate teeth commence to incline in the same direction, showing a marked triangular space between them at the line of the gums. In profile, the ogive formed by the apposition of the jaws is more closed. The notch still remains in the superior corner teeth, but is less marked in this age from the increased horizontal position of the inferior corner teeth. The tables of the pinchers and the intermediate inferior teeth seem to converge at their posterior border, on account of their diverging in front; their antero-posterior diameters have become greater. The inferior corner teeth are always triangular in the upper jaw; the pincher teeth are usually leveled, although the cups sometimes remain in them for several years more.

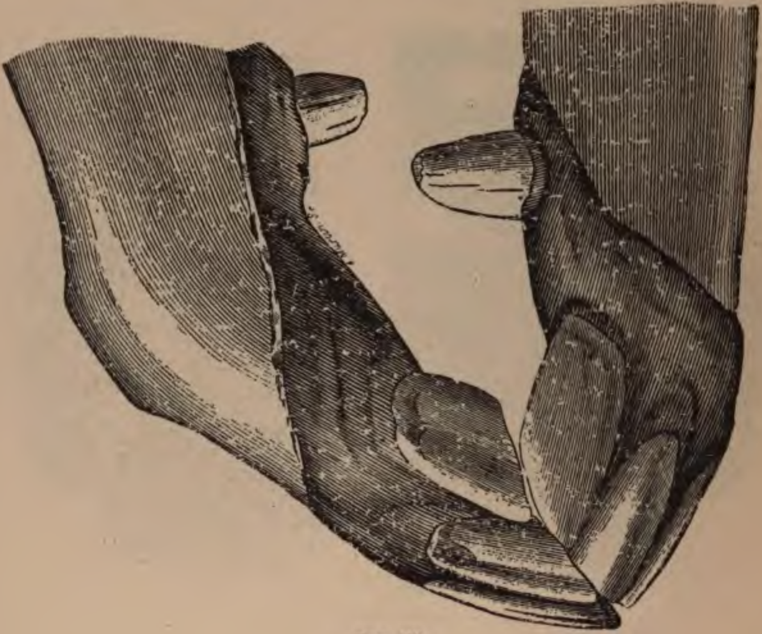


FIG. 119.

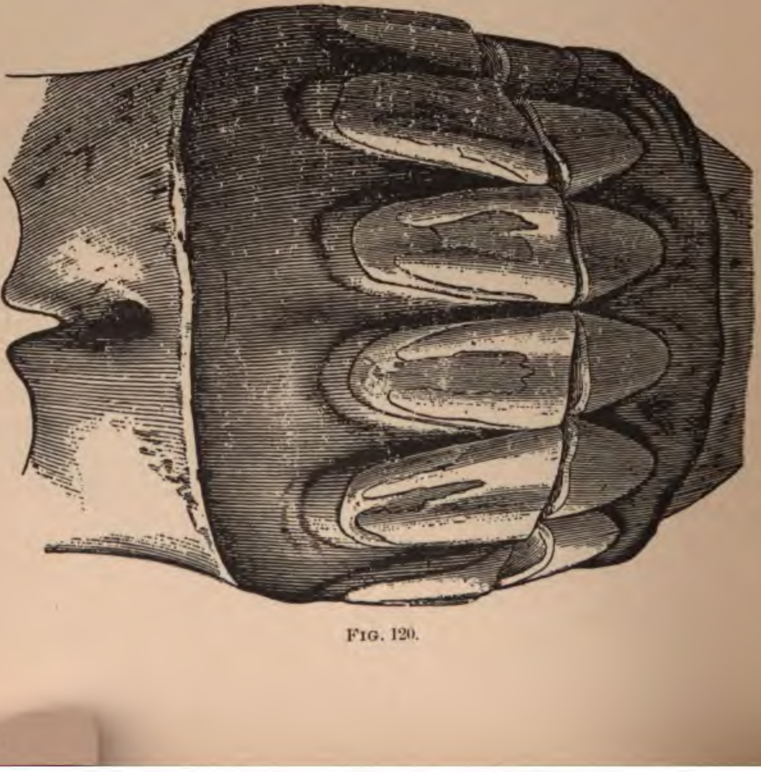


FIG. 120.

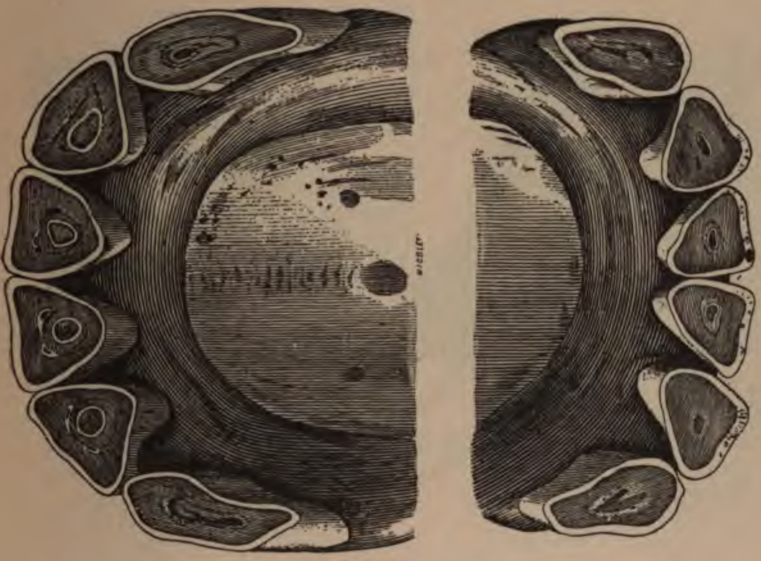


FIG. 121.

Twenty-one Years (Figs. 119, 120, 121).—The teeth become so horizontal that, looked at in front, the inferior ones are scarcely seen unless the head is well raised. The triangular interspaces at the base of the superior incisors increase in size and the convergence of the free ends becomes more marked. In profile, the jaws are seen diminished in size; the inferior corner teeth have become almost horizontal and have worn off the notch on the superior corners. The wearing surfaces of these teeth become elongated from in front to behind and have lost their triangular shape. The tables of the superior pinchers and intermediate teeth are elongated from in front to behind and distinctly triangular; they are generally leveled. The tables of the inferior teeth commence to flatten from side to side and are more distinctly separated.

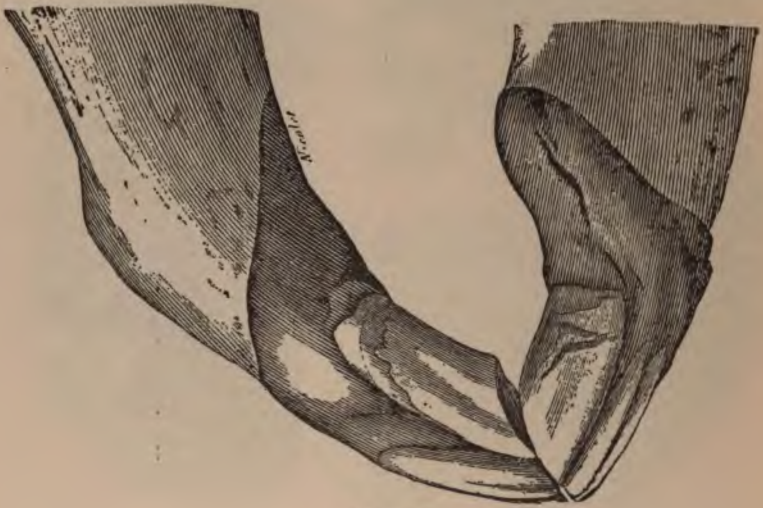


FIG. 122.

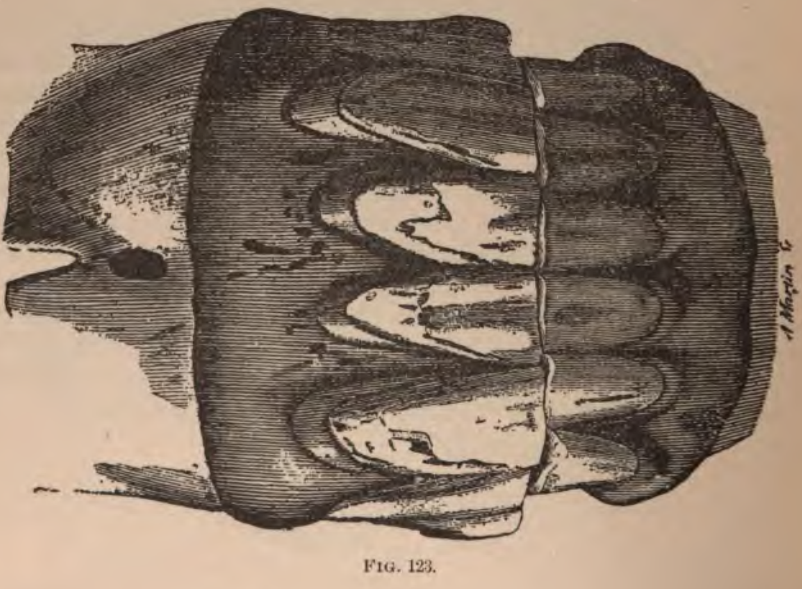


FIG. 123.

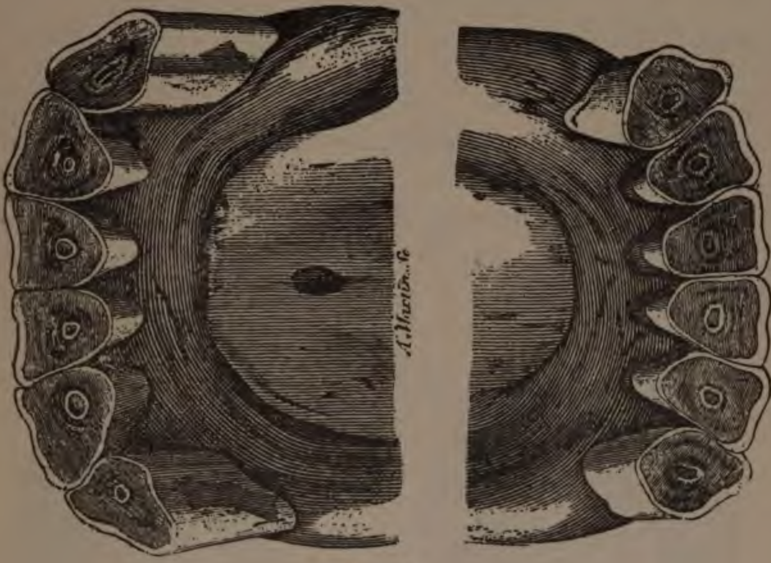


FIG. 124.

Thirty Years (Figs. 122, 123, 124).—This plate shows the character of extreme old age. In front, the superior incisive arch overlaps the inferior, which has become considerably narrower; the convergence of the corner and intermediate teeth becomes more marked. In profile, the inferior incisors are almost horizontal, especially the corner ones; the jaws are thinned and are wider apart from each other in the region of the bars. The tables of the inferior teeth are flattened from side to side (biangular). The peripheral enamel has almost disappeared from the posterior border of the teeth. In the upper jaw the tables are flattened from side to side and the enamel is nearly worn away. Sometimes in one or in both jaws the teeth have acquired an extreme length and are not leveled; or, at other times they are worn away almost to the roots and level with the gums, and are surrounded by a large deposit of the radical cement which covers the dentine, while the enamel has entirely disappeared.

IRREGULARITIES OF THE DENTAL SYSTEM.

The dental system offers a large number of very interesting and important irregularities. When these exist the horse is said to have an irregular mouth, or to be falsely marked. Some of the irregularities are without importance, while others may influence the wearing of the teeth to such a degree as to make the determination of age excessively difficult, except by a careful study of all of the changes and a comparison of the indications furnished by the other parts of the body.

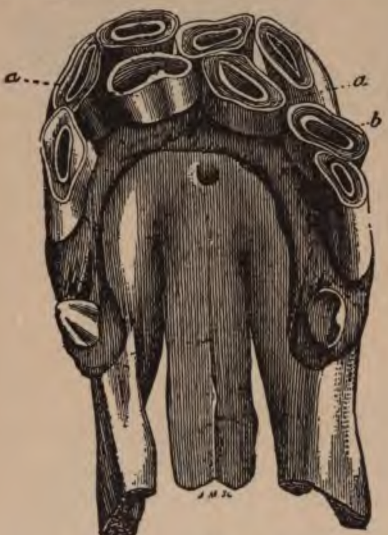


Fig. 125.

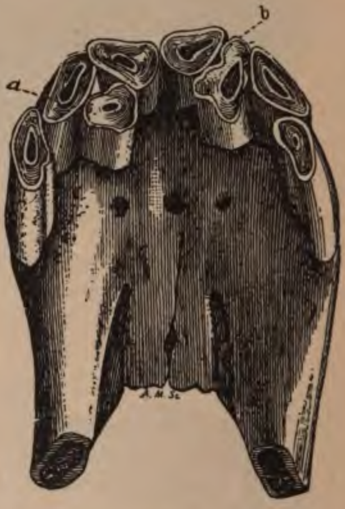


Fig. 126.

The irregularities can be classified as follows:—

1. Number,—augmentation and diminution.
2. Form of the incisors.
3. Uniting of two incisors.
4. The form of the cup; fissure of the dental cup.
5. Depth of the dental cup and size of its cavity (*bègue*).
6. Fault of length or excess of size of one of the jaws

(prognathism, brachygnathism); excess of length of the superior incisive arch.

7. Excess or fault of use.
8. Marks produced by cribbing.
9. Fraudulent alterations,—removal of the milk-teeth, bishoping, filing the corners.

IRREGULARITIES IN NUMBER—AUGMENTATION.

Incisors.—The most curious example of this anomaly is one which was noted for the first time by Lafosse, in 1772.

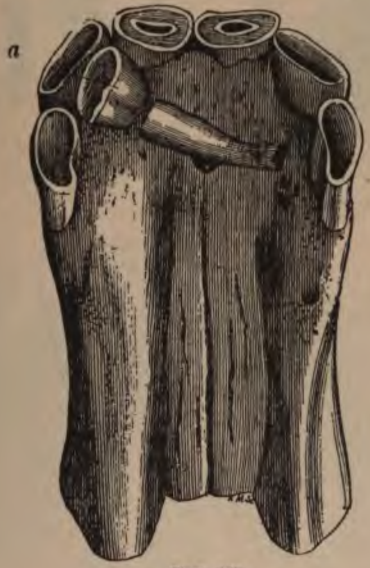


FIG. 127.

He states that he found horses with double rows of incisive teeth. This anomaly was again noted by Goubaux, in 1842. His case had two rows of incisors of second dentition in each jaw, making twenty-four in all.

Augmentation or duplication of the incisors of second dentition for one or two pairs of teeth is not rare. The accompanying plates give an excellent example. In Figure 125 there are two supernumerary pinchers (*a a*) and one supernumerary intermediate tooth (*b*). Figure 126 shows two supernumerary intermediate teeth (*a* and *b*). Figure 127 has an intermediate tooth

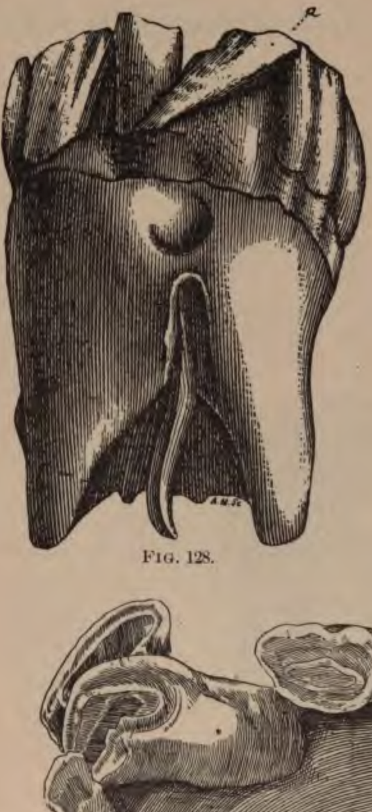


FIG. 128.

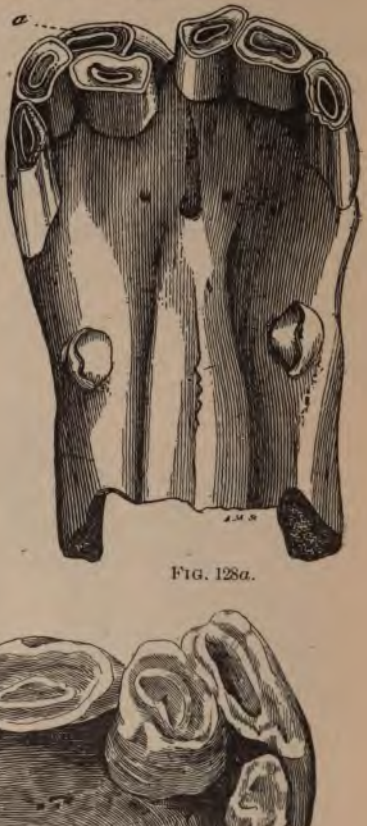


FIG. 128a.

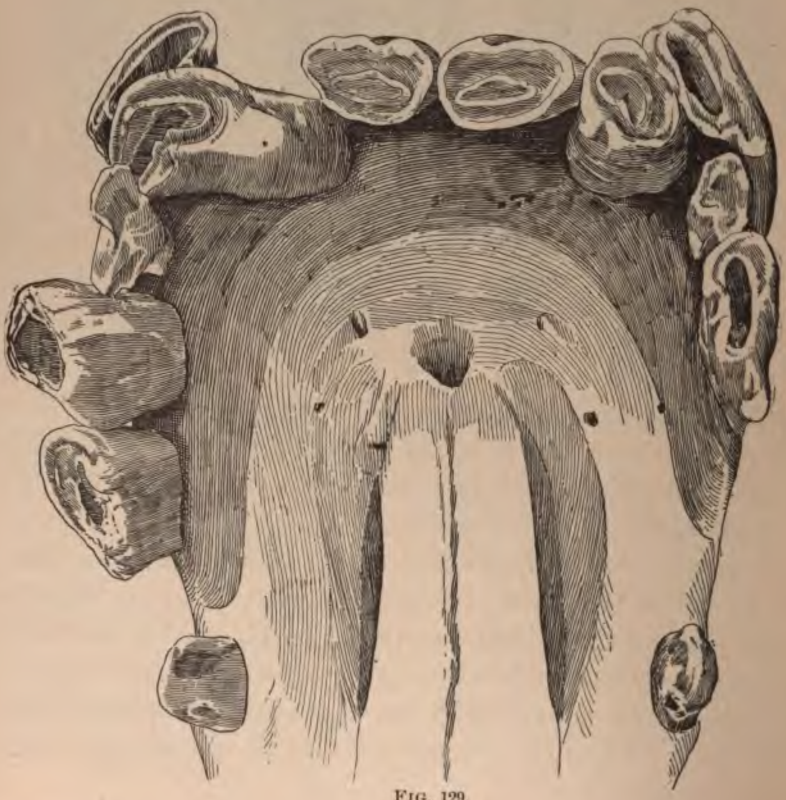


FIG. 129.

(*a*) directed transversely and held in place below the incisive foramen by a bony bridge.

Figures 128 and 128*a* show a pincher tooth similarly deflected.

All these teeth are of second dentition.

Supernumerary teeth of the lower jaw are less common than in the upper one; they sometimes, however, occur. The presence of supernumerary teeth rarely modifies the wearing of the others in the marking of age. Supernumerary teeth are usually firmly held in their alveolar cavities, and rarely alter the shape of the arch of the incisors except when milk-teeth are still remaining, with which they should not be confounded.

Figures 129 and 130 show an upper jaw from the collection of Dr. J. W. Gadsden, of Philadelphia, in which will be seen two supernumerary intermediate teeth, a right-hand supernumerary corner tooth, and the corner teeth of first dentition still remaining.

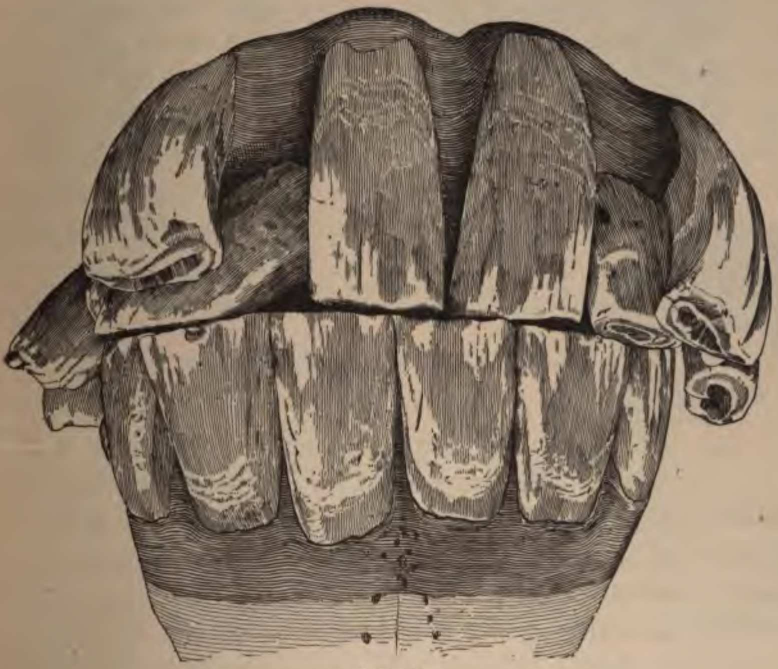


FIG. 130.

Tush Teeth.—Goubaux reports a case of an ass with a supernumerary tush tooth which seems unique (Fig. 131).

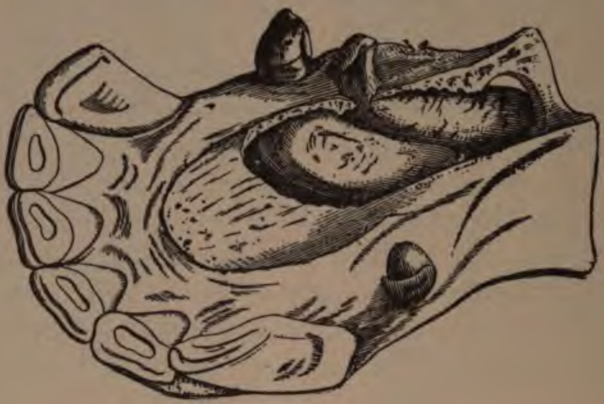


FIG. 131.

Molars.—Supernumerary molars have only been found in the upper jaw. They occur sometimes in line in the normal arch, at other times protrude to the outer side, in which case they may cause trouble by wounding the cheek. They have also been found under the zygomatic process at the base of the ear, where they may cause an abscess which opens on the exterior, and have been known to protrude into the cranium.

Figure 132 represents a sub-zygomatic molar, natural size, removed from an abscess under the ear of a three-month-old gelding, by Dr. W. J. Martin, of Kankakee, Kansas.

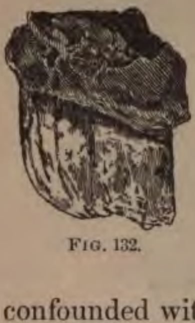


FIG. 132.

DIMINUTION.

Diminution in the number of the incisors is less frequent than the presence of supernumerary teeth. Diminution should not be confounded with cases of tardy eruption; nor with those cases of arrest of development, in which the teeth remain in their alveolar cavities; nor with cases of fracture or surgical injuries and loss of teeth. Diminution includes only the complete abortion of the dental follicles, and can sometimes only be determined by examination of the jaw after death. Incisor, tush, or molar teeth may be absent.

The tush tooth is the one which is most frequently absent, —a condition, however, which is practically normal in mares.

IRREGULARITIES OF FORM.

In certain subjects the incisors of the lower jaw present, at the age of six years, a decided triangular form, such as is usually seen at fourteen to fifteen years of age.

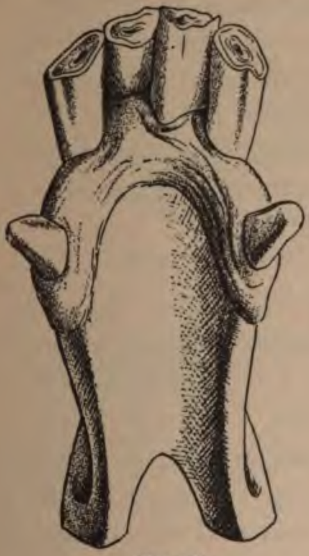


FIG. 133.
Absence of corner incisors.

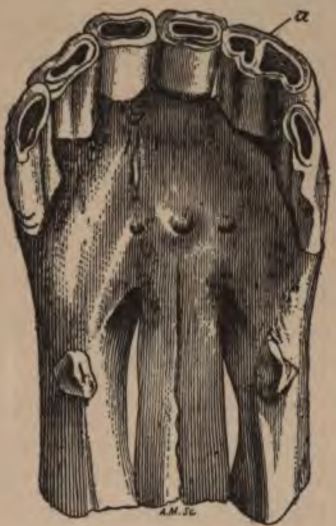


FIG. 134.
Double cup of left intermediate tooth.

This triangularity is readily distinguished from that of the older age by the presence of the cup.

IRREGULARITIES BY UNITING OF TWO INCISORS.

This sort of irregularity has no special importance as to the determination of age, but is interesting as a curiosity. Figure 134 shows the upper jaw of a horse with a double left-hand intermediate tooth, in which the two cups are perfectly distinct.

IRREGULARITIES IN FORM OF THE DENTAL CUP—FISSURE.

Fissure of the incisor teeth, by failure of the enamel on the posterior face to completely surround them, is rather more common in asses and mules than in horses. The fissure may represent only a small portion of the tooth, or it may constitute a complete division of the posterior surface, leaving the peripheral enamel in the form of a crescent (Fig. 136).

IRREGULARITIES IN DEPTH OF THE DENTAL CUPS.

Frequently the dental cup continues on the table of the teeth at a time when it should have disappeared. This occurs more frequently in very well bred horses in which the development of the teeth has been precocious, and in which the teeth have such a consistency and hardness that they do not wear away by use, as they do in more common bred horses.

EXCESS OF HARDNESS OF THE TEETH.

The nature of the food which the animal has eaten and the condition of health of the teeth are causes which tend to influence this irregularity. It is a condition rarely noticed before the age of seven or eight years.

The length of the teeth and the form of the dental tables are less to be considered in estimating excessive length of the teeth than is the form of the teeth and that of the cups.

EXCESS OF LENGTH OF THE DENTAL CUP.

Sometimes while the teeth have worn in the ordinary way, have diminished in length, and have undergone the usual changes in the shape of their tables, the cups continue in size and shape not corresponding with the other indications of age.

In these, an attentive examination of the tables of the incisors with reference to their shape; the size of the dental star, its situation; the condition of the upper incisors; the direction of the teeth, their length, color, etc., will rectify the faulty indications furnished by the cups.

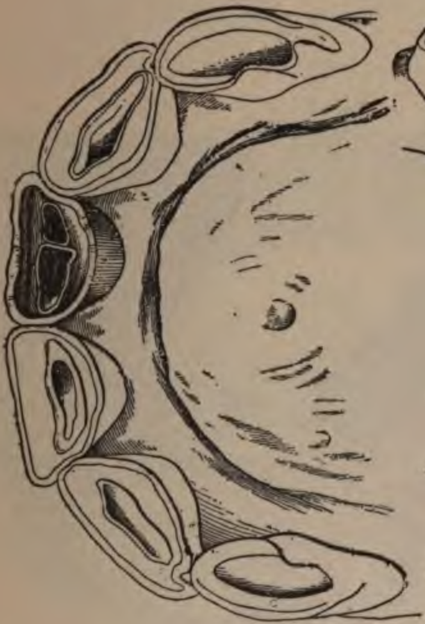


FIG. 135.
Double cup of left upper pincher and of left inferior intermediate tooth.

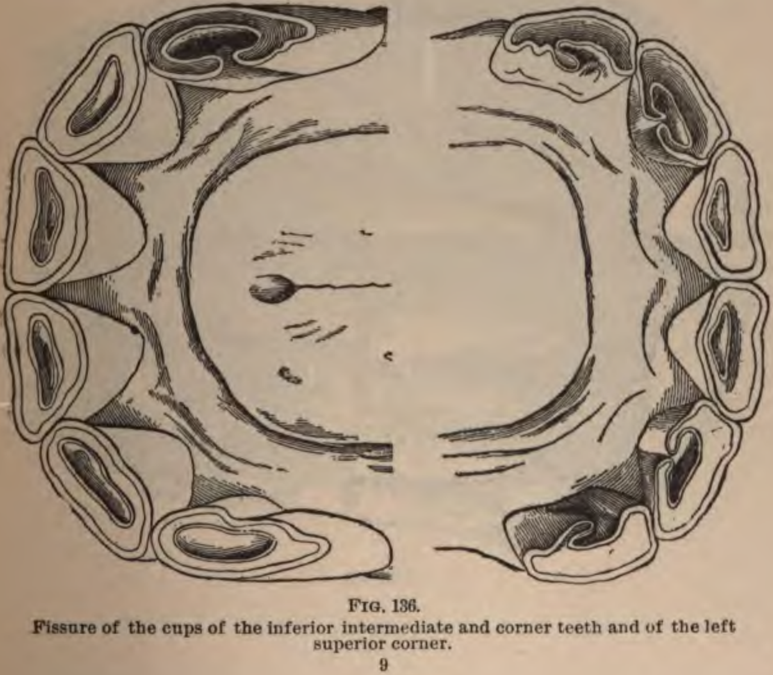
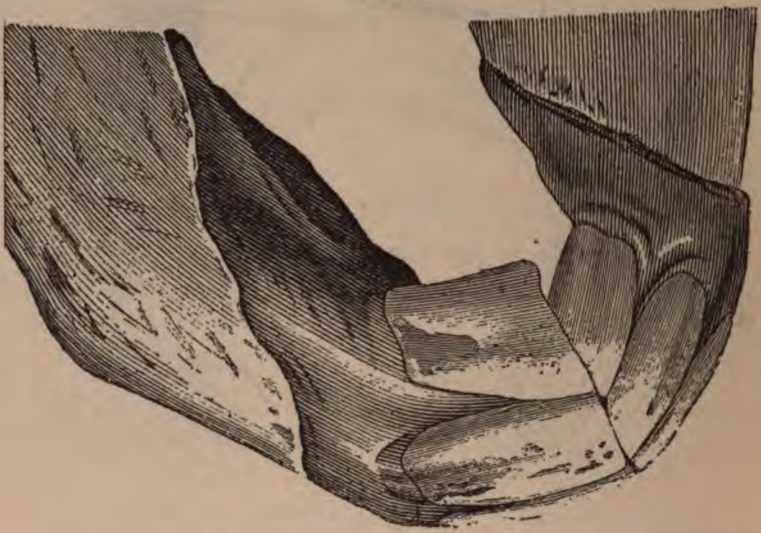


FIG. 136.
Fissure of the cups of the inferior intermediate and corner teeth and of the left superior corner.

FIG. 137.



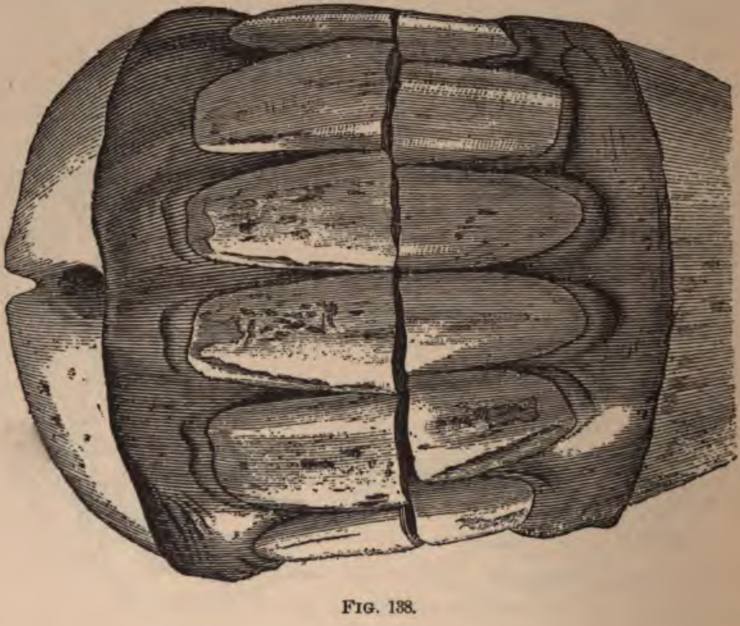


FIG. 138.

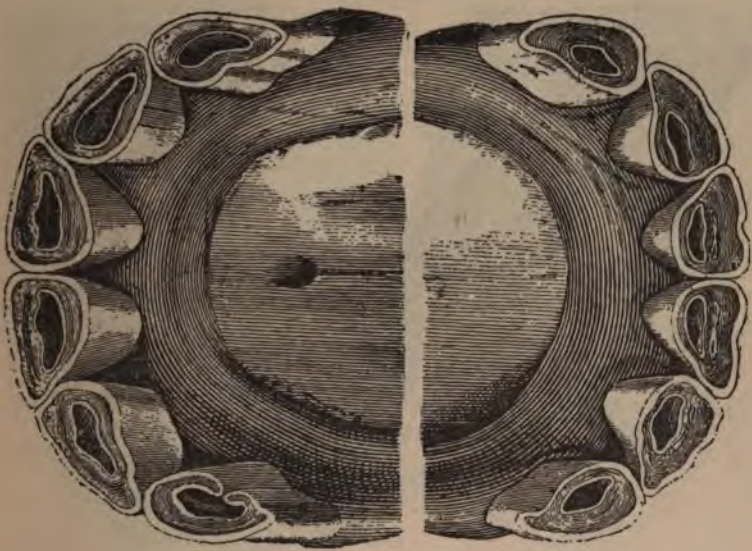
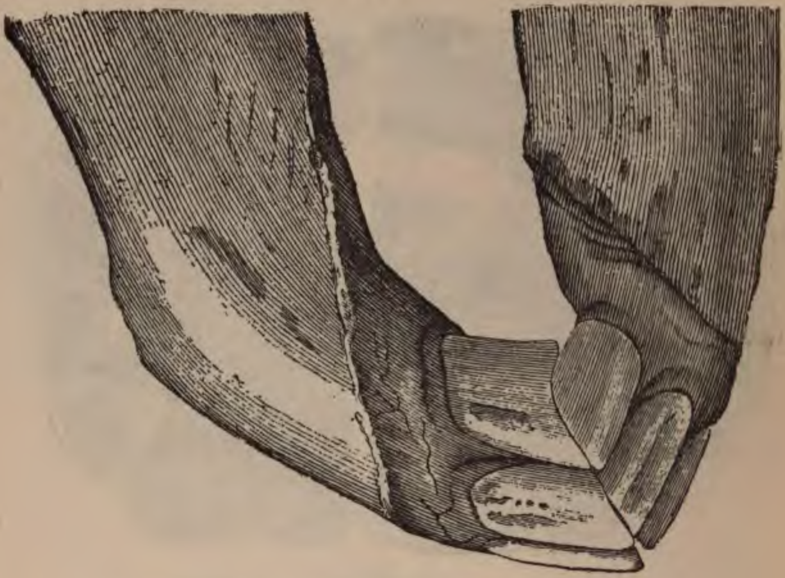


FIG. 139.

Nine Years (Figs. 137, 138, 139).—These plates are from the teeth of a horse nine years of age; the dental cups are of a size and shape representing a younger age. In profile, the incidence of the teeth is seen to be that of a horse five or six years of age; the inferior tables are round; the central enamel incloses small cups close to the posterior border of the teeth. The corner teeth are leveled and rounded; the dental star is near the middle of the teeth. These characters, added to the freshness of the corner teeth, the obliquity of the inferior incisors, the notch on the upper corners, and the general condition of the subject, are sufficient to rectify any error indicated by the first inspection.

FIG. 140.



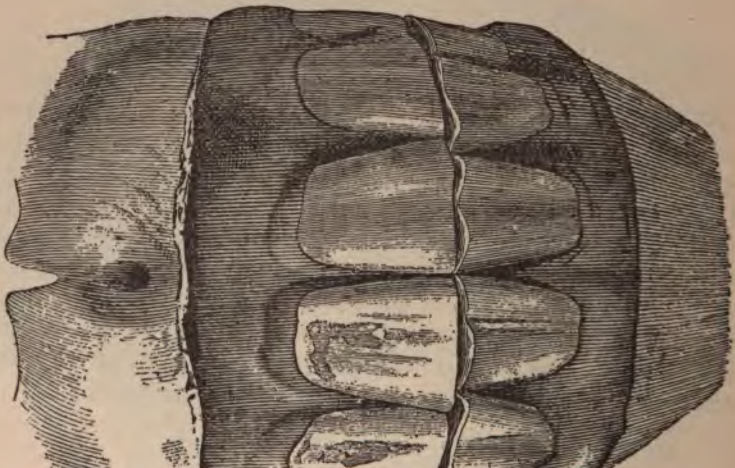


FIG. 141.

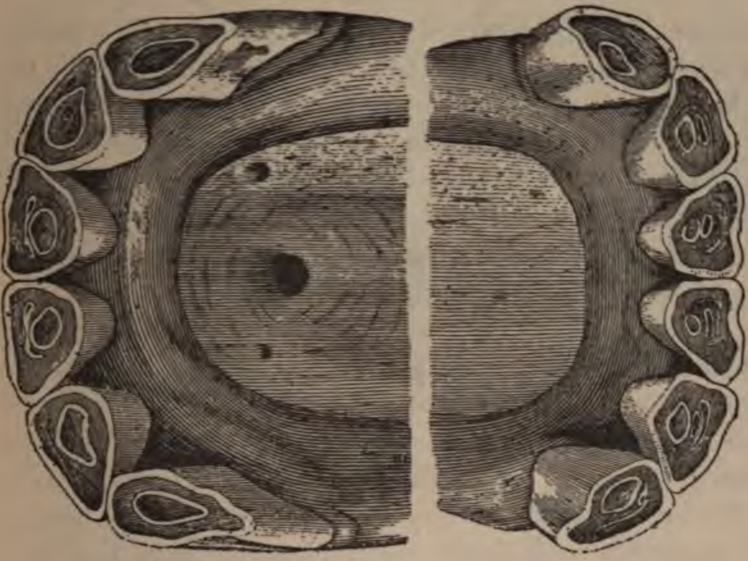


FIG. 142.

Fourteen Years (Figs. 140, 141, 142).—This figure is taken from the mouth of a horse fourteen years of age. The leveling of the teeth would only indicate about ten years of age, but a close examination of the tables shows (1) that the pinchers are nearly triangular; (2) the intermediate teeth commence to become so; (3) the dental star is perfectly distinct, narrow, and rounded; (4) the inferior incisive arch is depressed in its centre. Seen from in front, the teeth show no cement, and the inferior teeth are so horizontal as to be hidden unless the head is raised. In profile, the inferior corner tooth is no more oblique than that of a horse ten years of age, is narrow in front to behind, and has about the same diameter its entire length. The superior corner tooth is notched. The incidence of the incisive arches is acute. All of these characters indicate that it is older than would be supposed from the first observation of the teeth.

IRREGULARITIES FROM FAULT OF LENGTH OR EXCESS OF SIZE OF ONE OF THE JAWS.

Deficiency in length of either of the jaws is rare in the horse, but sometimes occurs. The simplest form is where there is a slight projection of the lower jaw (prognathism in man); in this there is excessive wearing of the lower incisors, which complicates the determination of age (Fig. 143). A more serious abnormality is deficiency in length in the lower jaw (brachygnathism in man), which is followed by deformity of the intermaxillary bones; these curve down and interfere greatly with the prehension of food, especially at pasture.

In prognathism the lower table may project for a variable distance beyond the upper jaw, but it is rare that it extends beyond to any marked degree, and, while it causes the teeth to wear away rapidly, there is not often any alteration in the incidence of the jaws. In brachygnathism the difference in length of the two jaws may be very great, in some cases so great that the upper jaw completely overreaches the lower one, and by bending of the intermaxillary bones the upper teeth drop over the anterior face of the lower teeth, while the latter point their tables directly into the hard palate; in other cases the posterior face of the upper incisors wears against the anterior face of the lower incisors until both are beveled into sharp wedges (Fig. 144).

EXCESS OF WIDTH OF THE UPPER INCISIVE ARCH.

This condition is normal in old horses, without inconveniencing them. It sometimes occurs in young horses, in which the irregular wearing against the upper teeth produces marked notching and sometimes interferes with the prehension of food; in one case, in a well-bred Hambletonian mare, in which the excess of breadth of the upper incisive arch was due to the presence of supernumerary corner teeth, giving the arch eight teeth in all, the deformity was very marked.

IRREGULARITIES BY EXCESS OR FAULT OF USE.

As a general thing the incisive teeth have the same length in their free portion, although the whole tooth is constantly

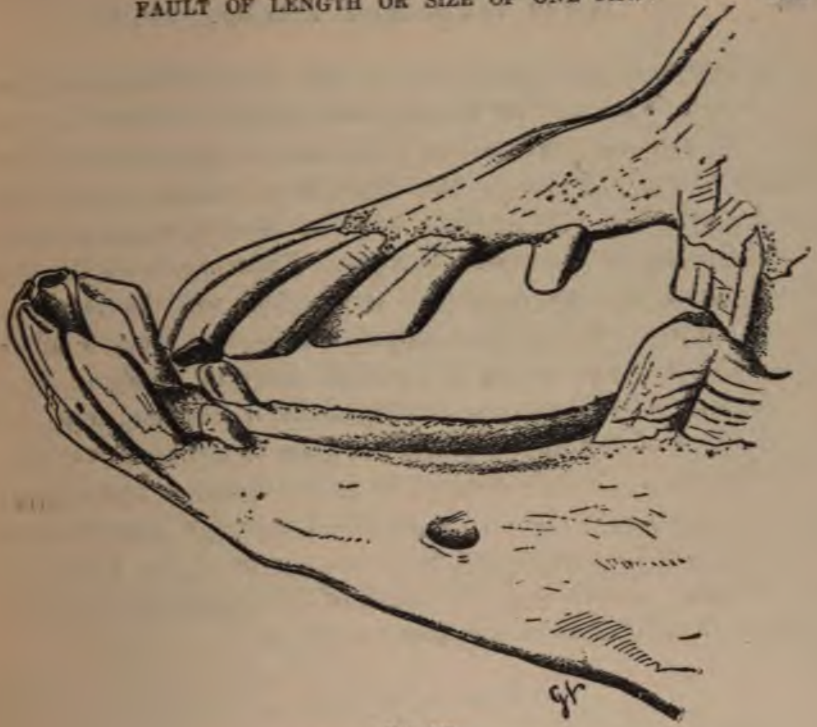


FIG. 143.
Superior brachygnathism.

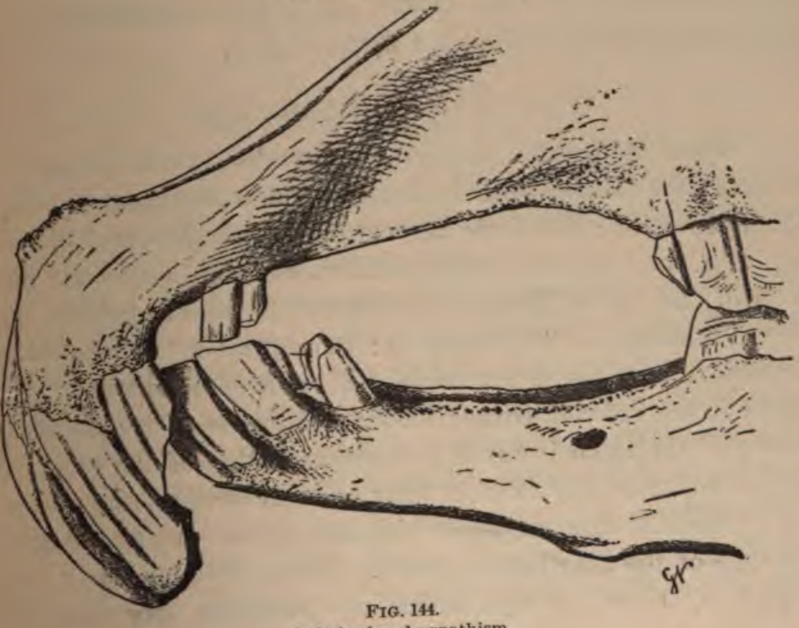


FIG. 144.
Inferior brachygnathism.

shortening each year, from the wearing away of its table; this even length is maintained by the roots being constantly forced from the alveolar cavities and becoming a part of the free portion; transverse lines, filed at definite points on the anterior surface of the incisors, will be seen to approach the table and disappear, one after another. Experiments by Pessina showed that in common horses the annual wearing is about 4½ millimetres, while in thoroughbreds it is only about 3 millimetres; experiments by Bouley verified those of Pessina.

Girard, after numerous investigations, determined that the free portions of the incisors, from the gum to the table, average 15 millimetres. This is subject to some variation, but normal pinchers rarely vary from 18 millimetres in length, intermediate teeth beyond 15 millimetres, while corner teeth are about 13 millimetres. Variation in the length of the incisors may be from excess of length or from deficiency of length.

EXCESS OF LENGTH.

This anomaly occurs in several ways, either occurring in both jaws, or in the teeth of the upper jaw alone, or at times only in certain teeth of one or the other jaw.

EXCESS OF LENGTH OF BOTH JAWS.

When the teeth of both jaws are too long, there is a general tendency for them to become parallel; that is, to approach a horizontal direction; but their free extremities are diverged like the ribs of a fan, and the wearing surface, or table, shows the character of the age of the horse; flattened in front to behind, they do not tend to take an oval form; the central enamel occupies a large portion of the dental table. There is often a little external cavity in the inferior corner teeth; the excess of length of the crown of the tooth is not in proportion to that of the root; the teeth are less solidly fixed in their alveolar cavities, and are subject to fracture from moderate violence, on account of the great leverage of the lengthened crown. These teeth on their table apparently show an age which is sometimes very deceptive.

To determine the exact age, it is necessary to shorten, by the imagination, the elongated teeth; determine by a close examination what would be the form of the tables of the teeth were they cut off to their proper length, what would be the form and position of the cups and dental stars in such a shortened tooth, and give to the animal the age which the alterations indicate.

Cutting off incisors of great length in a young horse need not be considered a fraudulent act on the part of the dealer, for, while shortening of the long teeth of old age is a trick to deceive the ignorant, who associate long teeth with great age, the shortening of the teeth of a young horse gives a table indicating a greater age, and will not deceive the expert, who should always examine any horse on purchase.

EXCESS OF LENGTH OF THE INCISORS OF THE UPPER JAW.

This anomaly constitutes what is commonly known as *parrot-mouth* (Figs. 145 and 146), on account of the analogy in the appearance of the upper jaw to the corresponding beak of this bird. The upper teeth may acquire a length of 2½ inches, and are frequently very much curved forward and downward, while their posterior faces are worn away to a sharp bevel by their contact with the inferior incisors. These latter are frequently shorter than normal, and the parrot's beak is formed by the pincher and intermediate teeth, with only the internal border of the corner teeth, while the rest of the latter is worn into a deep notch. These deformities are frequently much greater on one side of the jaw than on the other.

In some horses five years old the upper jaw projects a line or two in front of the inferior jaw, whilst the posterior surface of the teeth in both jaws corresponds, which produces excessive wearing of the posterior part of the upper incisors, leaving a little line in front of their table, which predisposes to the formation of parrot-mouth. Usually, however, parrot-mouth is only seen in very old horses. It interferes more or less, according to its development, in the prehension of food, especially with oats, as the projection of the teeth interferes somewhat with the move-

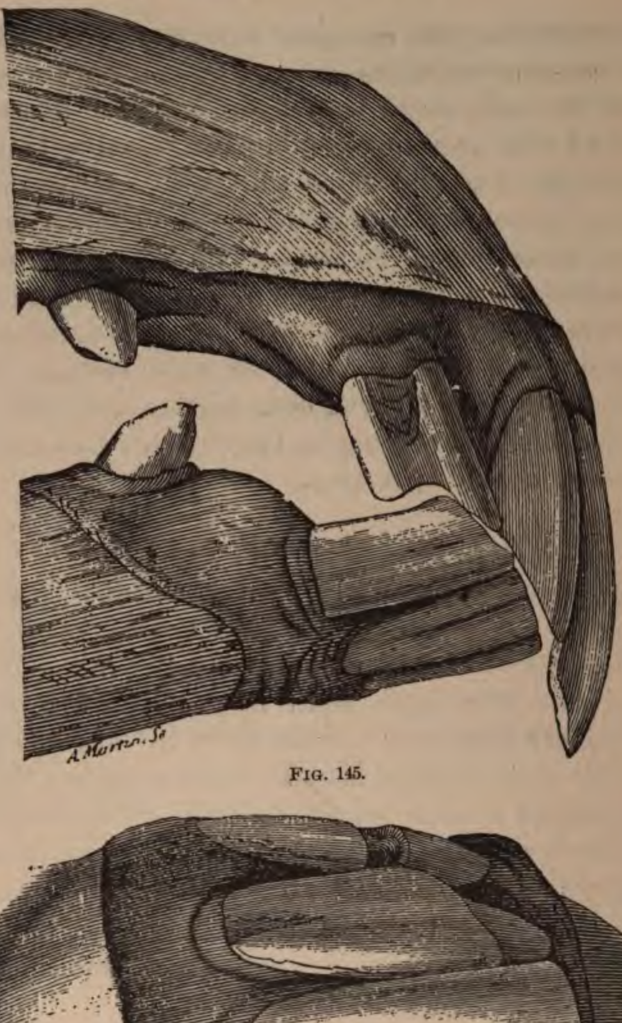


FIG. 145.

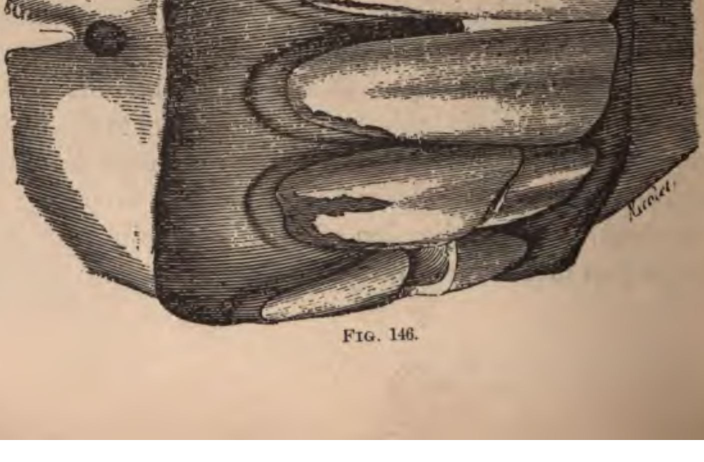


FIG. 146.

ments of the lips; the elongated teeth also render less the maximum extent to which the incisors can open than in a normal mouth; the latter can usually open 2½ inches, or a little more, while in certain parrot-mouths the space between the open incisors is only 1¼ to 1½ inches. The beveled and distorted tables of the incisors in a parrot-mouth render the determination of age, for these, practically impossible. The judgment of age may be based upon the relative characters, as to the inclination of the teeth, their color, their size, and what one supposes would be their tables were they cut to their proper length. It frequently happens that a parrot-mouth so interferes with mastication, on the part of the animal, that it becomes necessary to resort to operative measures with the saw and file to give the animal a normal mouth. This operation not only relieves the animal, but restores it to the appearance of its approximate age, and does not enter into the category of fraudulent measures.

EXCESS OF LENGTH OF THE INCISORS OF THE LOWER JAW.

A condition which might be called a reversed parrot-mouth is sometimes seen, which seems to be caused by a slight

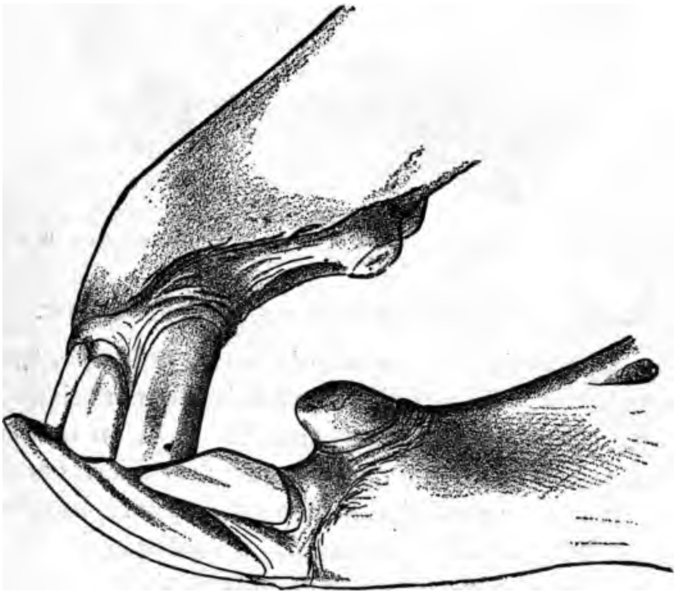


FIG. 147.

prognathism of the lower jaw, or a deficiency of the teeth of the upper jaw. It is usually limited to the pinchers and intermediate teeth (Fig. 147). This condition is more frequent in mules than in horses, and produces great inconvenience in seizing food, frequently requiring operative interference.

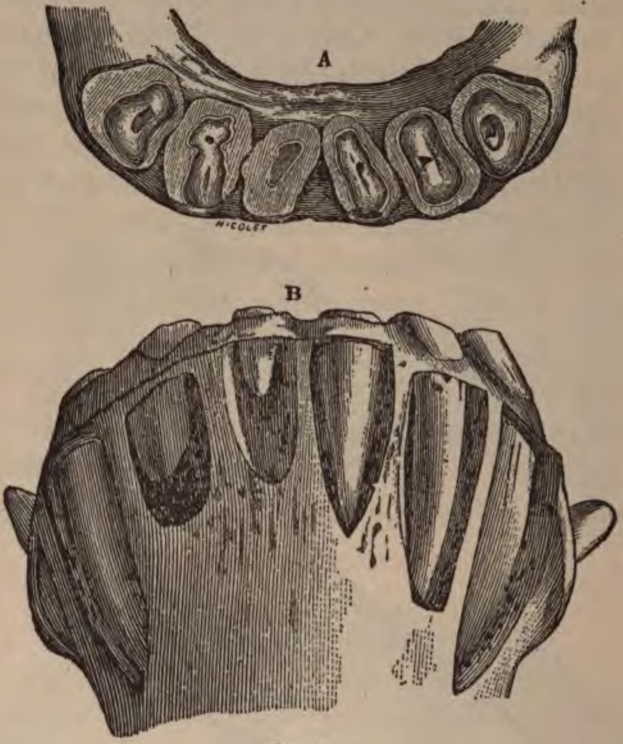


FIG. 148.
Deficiency of length of incisors of the lower jaw. A, dental tables. B, roots shown in their alveolar cavities.

EXCESSIVE LENGTH OF SINGLE TEETH OF THE JAW.

Mouths occasionally are seen in which only one, two, or a small number of teeth are distorted; this occurs at times on one side only, or it occurs frequently that the teeth on one side are very long and those on the opposite side very short, corresponding with an inverse condition in the other jaw. In cases like this it should always be the rule, as is necessary in all horses to determine age, to inspect them from both sides. In horses of seven or eight years old, a slight increase of wearing on one side of the jaw will frequently make, in the table-mark, a deviation of a year or two in the appearance of the animal's age, which is readily corrected by a further examination from the other side.

DEFICIENCY OF LENGTH OF THE FREE PORTION OF THE INCISORS.

Deficiency of length is seen only in very old horses; the teeth are always in apposition, except in the case of cribbing horses, when they may be so worn off as not to reach those of the other jaw. The diminution in the length may be so great that nothing but a mere stub remains. This condition is frequently accompanied by *cementoma*, or tumors thrown out by the irritated alveolar periosteum (Fig 148).

MOLAR TEETH.

As in the case of the incisors, the irregularities of the molar teeth are due to excess and deficiency of length. This may occur on one or both sides of the jaw, on all of the tables of an arch, or only on certain teeth.

DEFICIENCY OF LENGTH OF THE .CROWN.

Inferior Jaw.—The abnormal use of the molars rarely extends to all of them in an arch; sometimes those in the centre of the arch are the most worn (Fig. 149), giving it a concavity, in which the corresponding elongated teeth of the upper jaw fit; or sometimes they are worn most at the extremities of the arch, with an inverse condition of the upper jaw (Fig. 150); in molars which have been excessively worn the crown may have disappeared, leaving the roots as distinct and apparently supernumerary teeth (Fig. 149). In this case, as was noticed in the study of the structure of teeth, when they are worn down, they produce an irritation of their alveolar cavities which causes an excessive deposit of callous bone or cement, which unites them together and aids them in their function, but sometimes causes annoying bony tumors; however, the new function is not as complete as the original one, as the hard enamel has disappeared and the wearing surface is much softer; the mastication is not complete, and the animal shows the effect of a lessened nutrition.

Superior Jaw.—What has been said of the lower jaw applies to the upper, but the changes in them are less frequent.

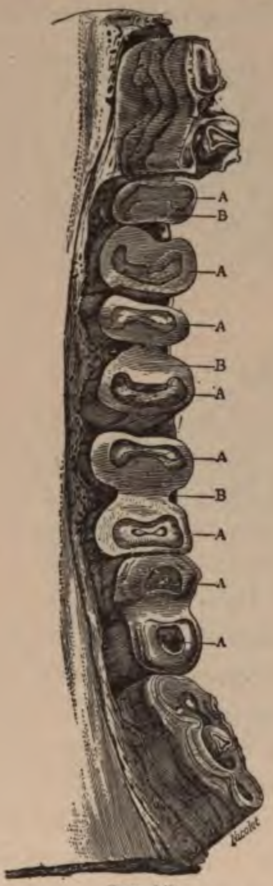


FIG. 149.
Lower molar arch of a very old horse.

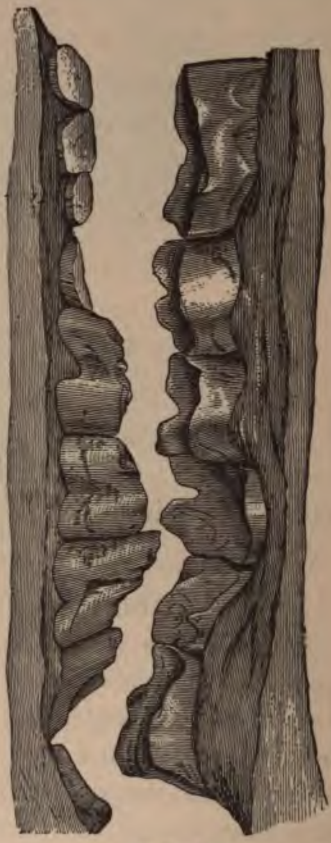


FIG. 150.
Molar arches (right) of a very old horse.
Lower jaw to the left of figure.

The separation of the roots in the upper jaw is less common, as these teeth are longer and contain a greater amount of enamel.

EXCESS OF LENGTH OF THE CROWNS.

Excess of length of the crowns or portions of them is of rather common occurrence. As the upper molars are broader as well as longer than the lower ones, the lower jaw is obliged to have a lateral movement in order to grind against the whole table of the former. When the horse is fed under the ordinary conditions of nature, finding coarse weeds, twigs, hard vegetable matters and resisting substances, as dirt, etc., mixed with its food, this lateral movement is rendered complete by the slowness and difficulty of mastication, and the teeth are kept worn evenly. When, however, the animals are given selected fine hay, cleaned oats and slops and mashes, easy of mastication, they use the jaws like a chopping machine, and all parts of the grinding surfaces are not brought into contact. Again, when horses, like cab-horses, doctors' hacks, etc., are fed at irregular times and in a hurry, they masticate incompletely, give the jaws but little lateral movement, and the narrower, lower jaws wear only against the internal portion of the tables of the upper teeth. When from any cause, such as caries of a tooth, cementoma, disease of any kind, or deformity, the animal chews more on one side than the other, the normal bevel of the teeth throws the wearing surfaces from their natural position, and, while some portions are worn faster, others do not receive the proper amount of use. When one or more teeth have been partially destroyed or lost, the opposing teeth, finding lessened resistance, become excessive in length and frequently irregular in shape. The irregularity of shape from any of the above causes is usually in the form of an increased bevel. Only the internal surface of the upper molars is worn, causing the formation of a little ledge along their outer borders. This acts as a check to lateral motion of the lower jaw, soon prevents it altogether, and cause and effect promptly react on each other. The external borders of the upper jaw become long, thin, and sharp, and their irregular, ragged edges cut the cheeks and serve as lodging places for balls of food, which may decompose, causing further irritation to the mucous membranes. The internal borders of the lower teeth may become very long and stand up like so many arrow-points, cutting the tongue and even penetrating the hard palate. The pressure on the border of the teeth worn close to their roots and the lateral pressure due to the leverage of the crown on its root in the alveolar cavity produce further irritation and prevent proper mastication. The pain on one side frequently confines the grinding entirely to the other. The loss of the lateral motion also prevents the slight fore-and-back play of the arches of the teeth, and soon the anterior edge of the first molar above and the posterior edge of the last molar below grow into points, which may be very annoying to the animal; removal of the latter is troublesome to the surgeon. Disease of a molar in one jaw, or its absence from fracture or otherwise, is soon followed by complication in the opposing teeth of the other jaw. Fig. 152 shows a fourth molar in the upper jaw with a cavity which was the size of a hen's egg, into which points the fourth inferior molar, which, from want of resistance, has become elongated. The presence of a dental cyst probably explains the enlargement of the upper tooth and also the softness of its texture which allowed it to be worn hollow.

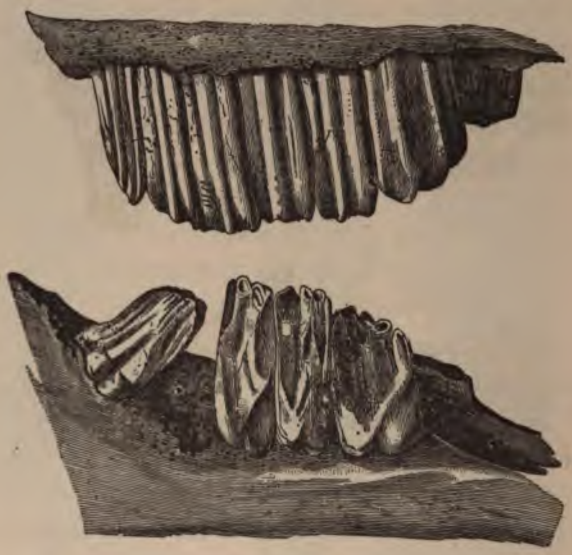


FIG. 151.
Irregular wearing of upper and lower molars.

Irregularity and deformity of the molars are the causes of much constitutional trouble; the interference with the mechanical action of the jaws and the soreness produced in them and in the cheeks and tongue render trituration of the food and mixture with saliva incomplete; the unprepared food is not digested and assimilated properly, causing a defective nutrition; the animal falls away in flesh, becomes hide-bound, and may have attacks of indigestion. The non-assimilation of the food causes indigestions and atony of the digestive tract and predisposes to intestinal calculi. The molars of all stable-fed animals should be looked to once or twice a year, including those of race-colts which are grain-fed from weaning. The inspection of the molars should constitute a part of examination for soundness.

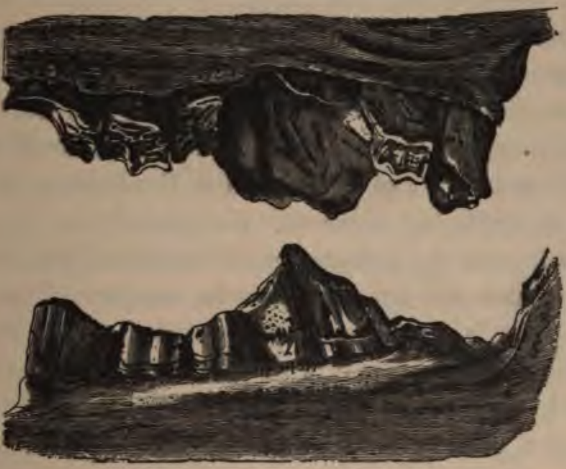


FIG. 152.

Hypertrophy of the upper fourth molar (right) with cavity for elongated corresponding molar.

ACCIDENTAL IRREGULARITIES.

Accidents from various causes, injuries, wounds, fractures of the jaw-bone, with or without loss of the teeth, and abnormal growths, may so interfere with mastication on one side of the mouth that they cause an excessive wearing of the teeth on the other side.

Vicious, nervous, and irritable horses frequently bite at their mangers, chains, wagon-pole, or other foreign bodies, and chip off the edges of the incisors, or they may even wear them to a considerable degree, so as to greatly change their form and tables and interfere more or less with the characters from which we judge the age. In many of these cases, however, the cause is evident, and the unilateral wearing, or the rough, irregular loss of substance, can be replaced by the imagination, and the accurate age determined.

IRREGULARITIES FROM CRIBBING.

Cribbing is recognized as of two kinds: 1st, that of the wind-sucker who pursues the habit, nose in air, and consequently produces no abnormal wearing of the teeth; and 2d, the cribber, who requires some foreign body between its teeth and wears them at the point of prehension. For the former, M. Goubaux proposed, in 1866, the name of "aëropinic."

According to the manner of cribbing and the character of the object which the horse chooses for support of the teeth, the wearing of the latter may be much varied. The object seized may be the feed-box, the rail of the manger, or a part of the stall, which may be horizontal or may be vertical; it may be the end of a poll or shaft, a chain, hitching-strap, or part of another horse's harness; in one case of the writer's, the horse would only crib on a small piece of wood when hung loose on a cord. Rare cases crib by seizing their own legs. Sometimes the support is only taken with the lips or the tuft of the chin, and in these there is no wearing of the teeth.

According to the size of the object, or the position assumed by the horse in cribbing, the contact of the teeth may be only by the anterior borders, only by the posterior borders, or by both; it may be by one jaw or by both; it may be by a number of teeth, or only by one or two teeth. In whatever manner the cribbing is done, but little force is used, and the worn surface of the teeth is smooth, even, and polished, so that it is readily distinguished from the roughened edges of teeth worn by vicious or nervous biting. When the support of the teeth has been taken, the animal makes an effort of deglutition, which is followed by a peculiar "cluck" sound. In examining an animal, even where the age is readily recognized, care should be taken to open the jaws completely, so as to inspect all surfaces of the teeth. While cribbing marks, when on the anterior face of the teeth, are apparent on superficial examination, those on the posterior face are often hidden by the foam and saliva, unless care is taken to wipe the latter away. A slight bevel worn on the anterior surface is evident, with the teeth closed, from the separation of the enamel and the presence of a yellow line, made by the exposed dentine, while a considerable bevel might be overlooked when its surface is a continuation of the yellow dentine of the table and is looked at from in front.

It is often of the greatest importance to determine if the irregular areas of use on a horse's teeth are due to accident, or are the result of cribbing. Undoubtedly, some cases of cribbing find their origin in the bad habit of cleaning a horse in its stall, where it can bite at and seize the manger, etc. In these cases the edges of the teeth are rough and jagged, and it is only after the habit becomes confirmed that the worn parts become smooth and polished and evenly used in their irregularities. In other cases, where attempts have been made to cure the horse of the habit, by fastening it so that it cannot reach the object on which it cribs, it changes its mode of cribbing and may wear various parts of the incisors, and then the teeth, losing the support of the enamal in front and behind, become very irregular and broken.

When the animal cribs by pressing the incisors against some foreign body, the wearing takes place on the anterior face of the teeth (Fig. 153, A, B, C, D).

When the object is seized in the mouth it may wear only the posterior faces (Fig. 154, A, B, C); or, if a thin board or similar body is held, it may wear the anterior borders of one jaw and the posterior of the other (Fig. 154, D, and Fig. 155, A).

If a thin object is seized evenly between the jaws, the tables of the upper or the lower or of both sets of incisors may be worn. In the latter case the age must be determined by the

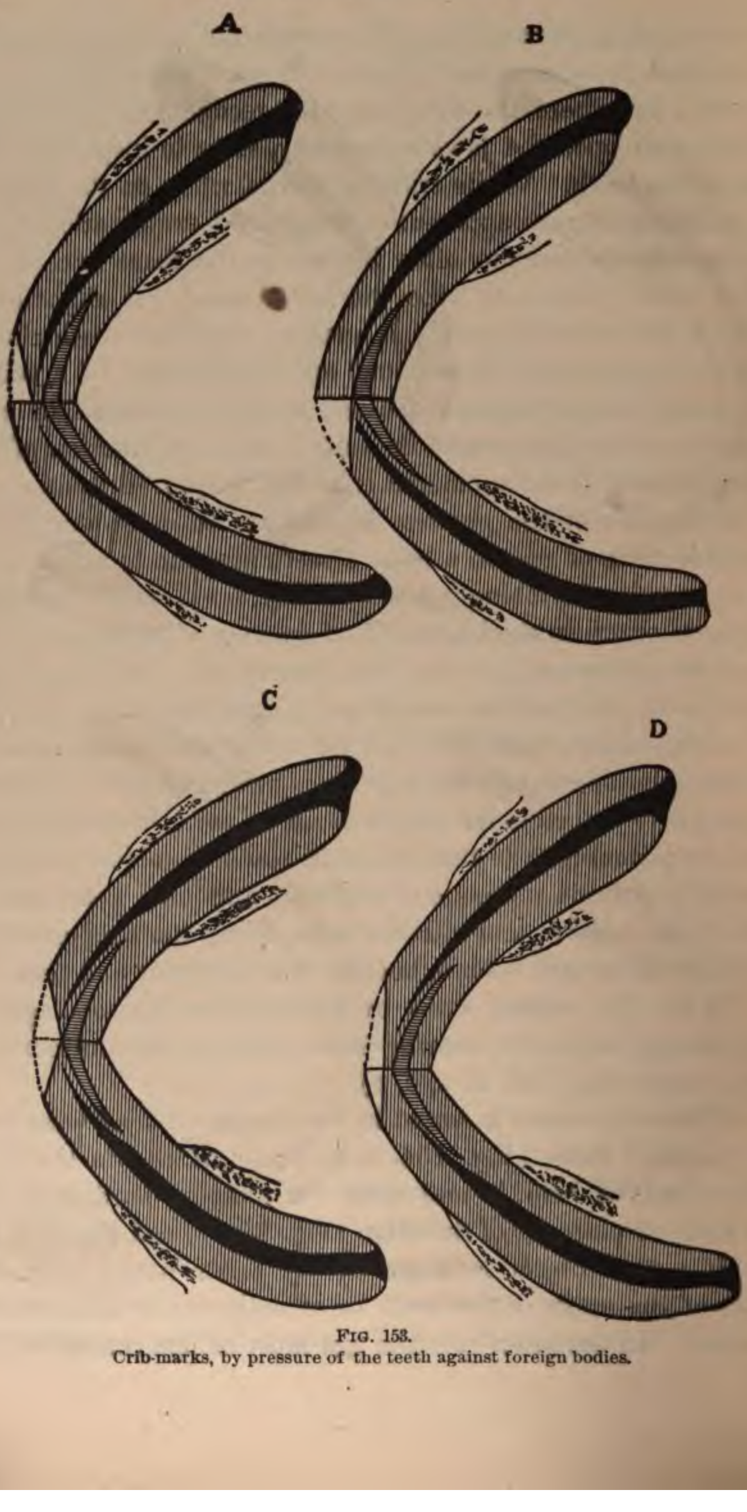


FIG. 153.
Crib-marks, by pressure of the teeth against foreign bodies.

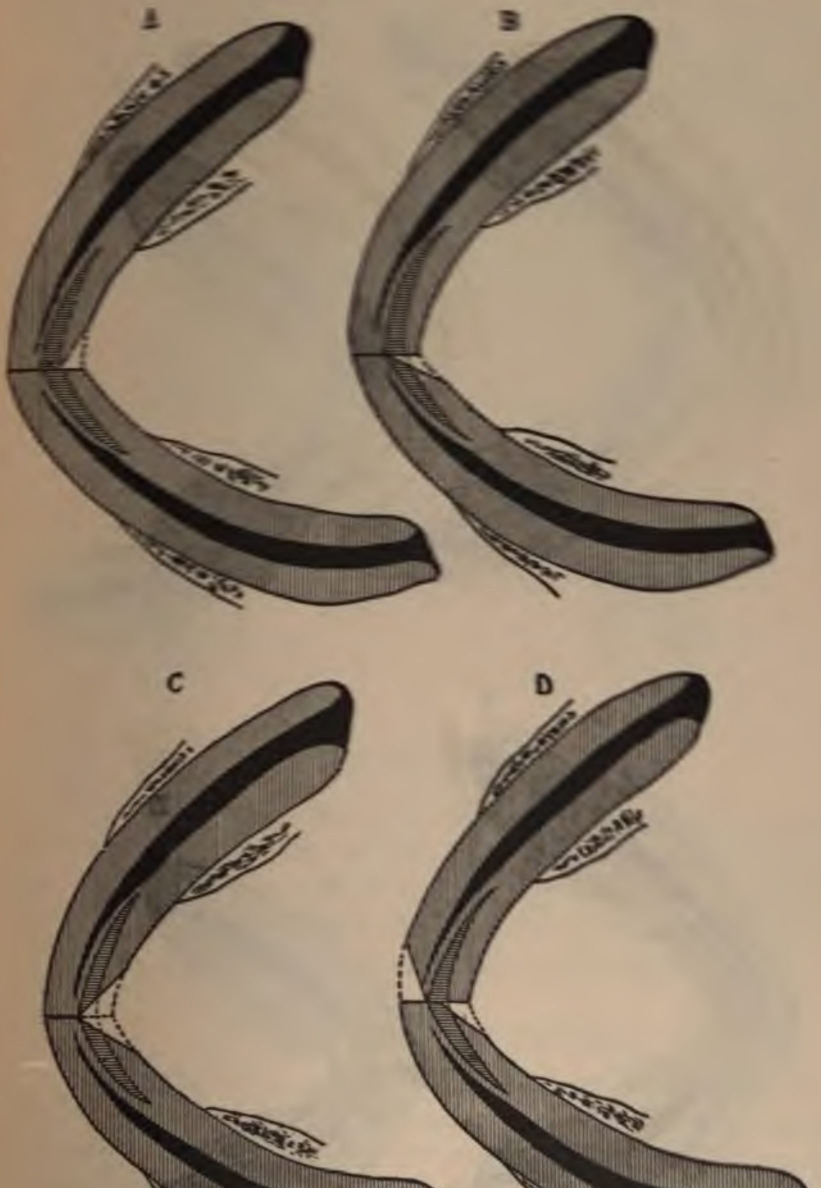


FIG. 154.
Crib-marks, by seizing foreign bodies inside of the jaws.

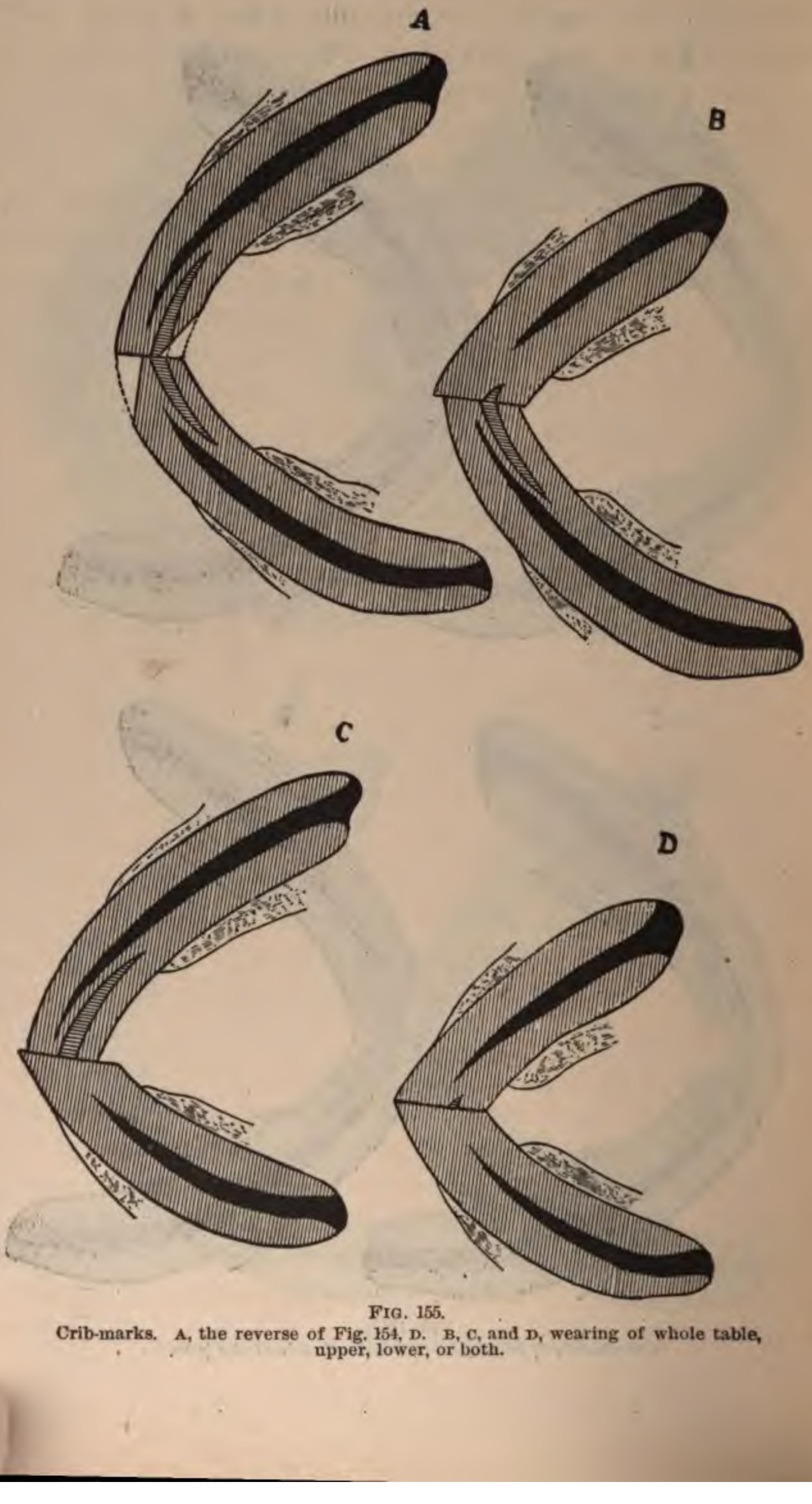


FIG. 155.
Crib-marks. A, the reverse of Fig. 154, D. B, C, and D, wearing of whole table, upper, lower, or both.

thickness of the maxilla, the obliquity of the shortened teeth, and their size as they emerge from the gums (Fig. 155, B, C, D).

Fig. 156 shows the wearing produced by vertical objects,—halter-straps, which the animal renders tense by backing to its full length; wires, small chains, etc.

Most horses crib only on a given character of object, and when removed to another stall, or fastened so that they cannot reach the regular resting-place, may stop the habit for a time or be broken of it entirely. Others will, sooner or later, find some other body that suits them and commence again; so that the same animal may have two sorts of crib-markings. Others, when tied up, will learn to crib in the air.

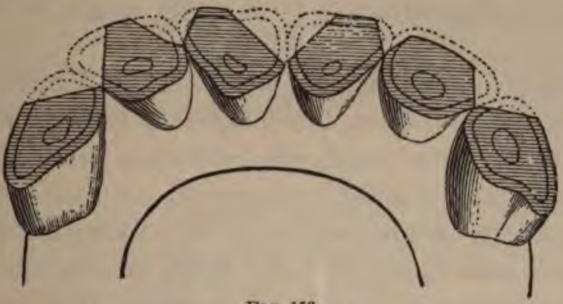


FIG. 156.
Cribbing on vertical edge of foreign body, or on halter-strap.

The rasp and file are sometimes used by dealers to shorten the incisors, and, while adding a little to the apparent age of the animal, remove the bevel which shows the habit of cribbing. A careful examination will always show a roughened surface, however, unlike the smooth polish of a naturally-worn table.

ARTIFICIAL IRREGULARITIES.

From time immemorial, the lower class of horse-dealer, like his congener in any other trade, has studied to learn and practice deceptive means for giving his articles for sale an apparent greater value than they really have. With this view, the dishonest breeder in the country attempts to hasten the appearance of age of his colts, to place them on the market as adult animals, and save a year's feed and cost of care when they are yet undeveloped; the city dealer fashions the mouth to destroy the evidences of cribbing, even at the risk of making the horse appear a year or two older, or alters the tables of the teeth to deceive the inexperienced buyer into thinking an old horse to be one just arrived at adult age.

Within recent years, moreover, especially in America, there has arisen a fraternity of "Equine Dentists," a guild endowed with great enthusiasm, who not only relieve the animals suffering from irregular and sharp molars, but, with artistic skill, remodel the whole mouth, and produce changes which sometimes greatly complicate the characters of the teeth as indications of the age of the horse.

REMOVAL OF TEMPORARY INCISORS IN ORDER TO AGE THE HORSE.

In Ireland, in Normandy (in France), in Virginia, and in some sections of the West, the temporary incisors are drawn some time before they would naturally drop to be replaced by the permanent ones, in order to hasten the eruption of the latter. If the intermediate incisors are drawn in a rising three-year-old, the permanent ones appear at three years, or soon after; and if the temporary corner incisors are then drawn, they are replaced in a few months by the permanent teeth; so that a rising four-year-old may have all of its permanent incisors, and the mouth of a four-year-old off may have the appearance of that of a horse a year older. The condition of the tush teeth does not control the age to any extent, as some horses have them between three and four years of age, and in others their eruption does not take place until six.

We have seen that when the incisors first appear they emerge from the gums somewhat obliquely, and later take their proper position, making their incisive arch a regularly rounded curve. When the permanent incisors have been hastened by the removal of the temporary ones, the former keep their oblique position, the arch is never regular, and is evidently diminished in width. If the removal has been recent the parts are inflamed, and there is sometimes a periostitis, which is evidently traumatic in origin. When such an irregularity is seen, the obliquity of the teeth in the curve of the incisive arch, a comparison of the two incisive arches (for frequently the deception has only been practiced on the lower teeth), and a comparison of the worn tables of the pinchers with the fresh edges of the others will be sufficient to show the fraudulent interference which has been executed. There are frequently cicatrices, showing the forcible removal of the teeth.

De Curnieu questions that the drawing of the temporary teeth hastens the eruption of the permanent ones; but Mayhew maintains the contrary, with which my own experience coincides. Mayhew says they can be hastened by the application of a hot iron to the gums. The question was put to a large number of breeders by MM. Goubaux and Barrier, and was answered, by all but one, in support of the opinion that the eruption of the permanent teeth is hastened by the removal of the milk-teeth.

BISHOPING.

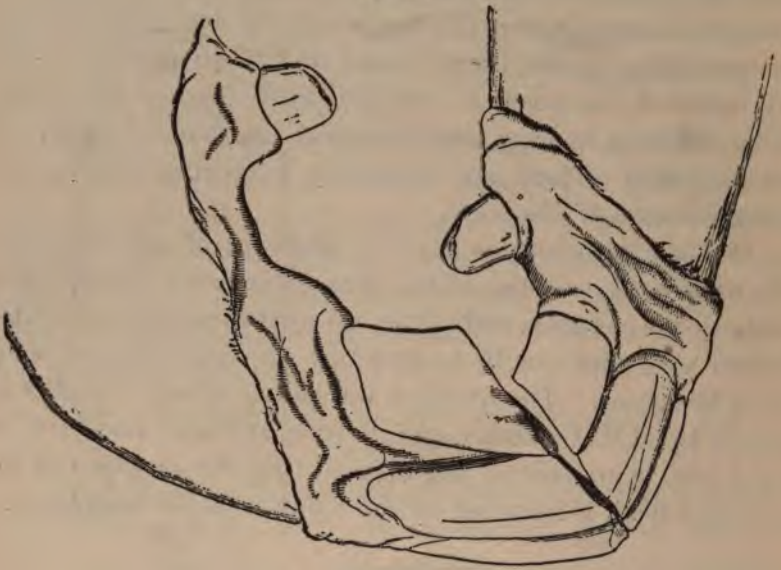
Bishoping is a method employed by gyps to alter the appearance of the incisors, which can only deceive buyers who are entirely ignorant of the horse's mouth.

The crowns of the incisors of the young horse are wide from side to side; the dental tables are modified as the animal becomes older, and become successively oval, rounded, and triangular; the cups at first occupy the whole table, and are usually filled with dark-colored cement or black foreign matter; they gradually diminish in size, approach the posterior border of the teeth, and then disappear. In the centre of the table the dental star appears.

Bishoping consists in giving to the tables an artificial cup of a dark color. The teeth usually are first filed even; each table is then gouged out until somewhat concave, and the new cup is then blackened, either by nitrate of silver or by a point of white-hot iron. It is only practiced on the lower incisors.

Bishoping is readily recognized on a proper examination; as, with the shortened lower teeth, the tables of the two incisive arches usually do not correspond (Figs. 157 and 158), and the

Fig. 157.



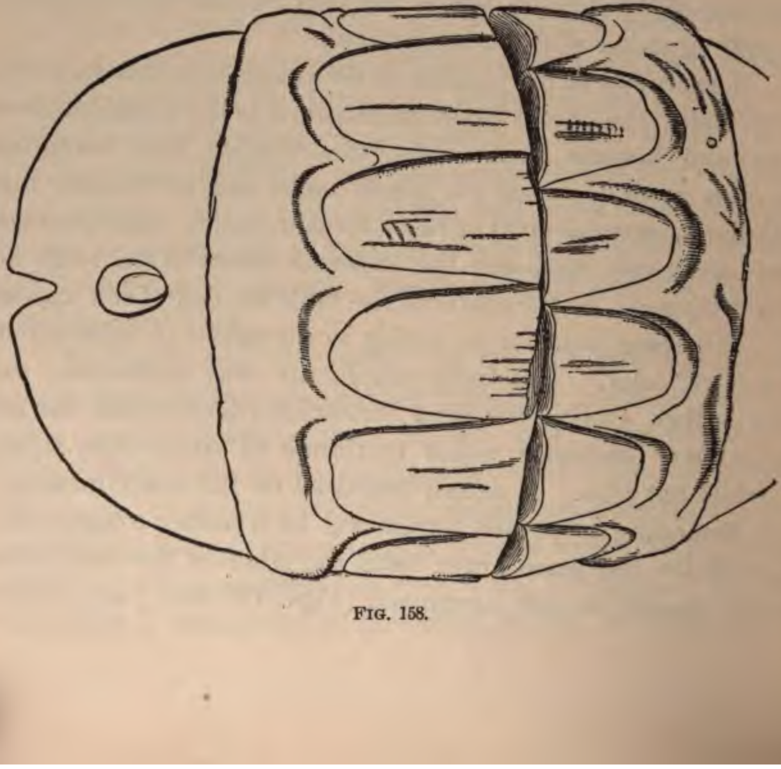


Fig. 158.

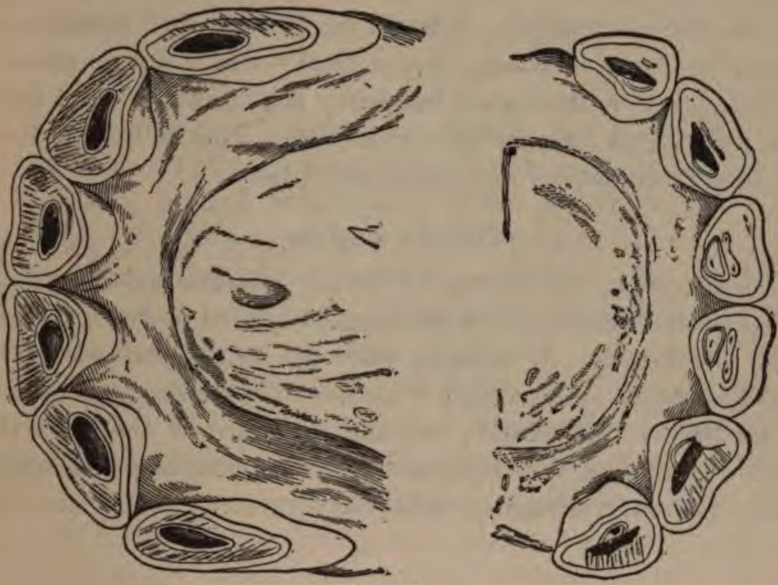


FIG. 159.

Bishoping (Figs. 157, 158, 159).—From in front the figure shows a space, above the corner and intermediate teeth, made by their having been filed. This is seen more plainly in profile. The tables show the roughened surface left by the file, and the artificial, blackened cups, at the posterior border of which are seen the real cups, surrounded by enamel.

enamel of the diminished cup of the horse is found posterior to the artificial cup, or has disappeared (Fig. 159). In bishoped mouths the artificial cup is found on the tables of wounded or triangular teeth, in which they normally would not be present. In bishoping the tushes are frequently filed down to point them and make them appear fresh and small. This is evident from the roughened surface and unnatural shape.

DRESSED MOUTHS.

The notch on the upper corner incisors and the whole tables of the incisive arches are frequently filed down in "dressing" the mouth. If recently done the roughened surface is evident, and at other times it may complicate the appreciation of age to a certain extent; but the incidence of the jaws, the form of the tables, the conformation of the maxillary bones, etc., should prevent a deception of any importance.

AGE OF THE ASS, MULE, AND HINNY.

To determine the age of the ass, mule, and hinny requires an extension of the rules which have been applied to the horse. In the young animal the eruption of the milk-teeth and their replacement by the permanent teeth are about the same.

In these animals the incisors are smaller and narrower and less conical in shape than in the horse. The crown of the teeth is much longer and the root is shorter. The dental cup is continuous until a late period of life, as it is proportionately deeper. The cups are often imperfect behind. As the teeth are harder and more resisting, they wear much slower, and consequently the tables change their form more slowly. The teeth are more solidly imbedded in their alveolar cavities, and an excess of gum fixes them firmly. The dentine is more discolored and darker; the whole tooth is harder and resists the wear of dense, fibrous food better than that of the horse, and consequently does not wear so fast. The form of the tables is of less value, while the form of the arch and the obliquity of the teeth are more important. After seven years the elongated teeth and their approach to each other in a horizontal line, with thinning of the maxilla and the deposit of cement, the dark color and the narrowing of the incisive arches, are evidences of age.

The dental tables change from a round to a triangular form, which is complete at seventeen or eighteen years. At this age the cups may disappear and be replaced by the dental stars. The incisors become parallel to the maxillary bones and converge at their free extremities in very old age.

AGE OF THE OX.

THE age of the ox has demanded much less study than that of the horse, on account of its shorter life and the more limited time in which it is utilized for specific purposes. In a growing animal the evidences of its youth are unmistakable. Arrived at adult life, the difference of a year or two in its age is less important, in regard to its value, than it is in the horse, and later becomes even less so. The age of the ox is determined by the changes which take place in its dentition and the wearing away of its teeth, and by the changes in the growth, form, and appearance of its horns.

DENTITION OF THE OX.

$$\text{Formula}\left\{\begin{array}{ll}\text{Temporary}, \quad . \quad . \quad . \quad . \quad . & \frac{0\,.\,0\,.\,3}{4\,.\,0\,.\,3}=20 \\ \text{Permanent}, \quad . \quad . \quad . \quad . \quad . & \frac{0\,.\,0\,.\,6}{4\,.\,0\,.\,6}=32\end{array}\right.$$

The ox has thirty-two teeth,—twenty-four molars, arranged as in the horse, in arches of six on either side of each jaw, and eight incisors in the lower jaw, with none in the upper. In rare cases there are rudimentary molars (wolf-teeth), but when these exist in the young mouth they drop before the permanent dentition is complete. Tush teeth are not present.

INCISORS.

The upper jaw is devoid of teeth, but the intermaxillary bones are covered by a dense cartilaginous cushion and strong gum, which furnishes a resisting body to the incisors of the lower jaw in the prehension of food.

In the lower jaw there are eight incisors, arranged like the ribs of a fan, on the spatula-shaped arch formed by the extremity of the maxillary bone.

The incisors, instead of being fixed solidly in their alveolar cavities like those of the horse, are imbedded in them on a layer of cartilage, which allows of a considerable amount of motion, and thereby probably protects the cushion of the upper jaw from injury in seizing food, which is crushed rather than cut off.

The two middle incisors are known as *pinchers*, the next ones on either side as *first intermediate* teeth, the next as *second intermediate*, and the outside ones as *corner* teeth.

The two pinchers are slightly separated on account of the cartilaginous symphysis of the maxillary bones in the ox; this is much more marked in the first dentition. The other teeth touch each other by their extremities and form a complete arch, but, from their shovel shape, are not in contact along their borders as the wedge-shaped incisors of the horse are.

The incisors are composed of a crown and a root, separated by a distinct neck, giving them a somewhat shovel shape. The crown or free portion is flattened from above to below, and becomes (Fig. 160) thinner and broader at its anterior extremity.

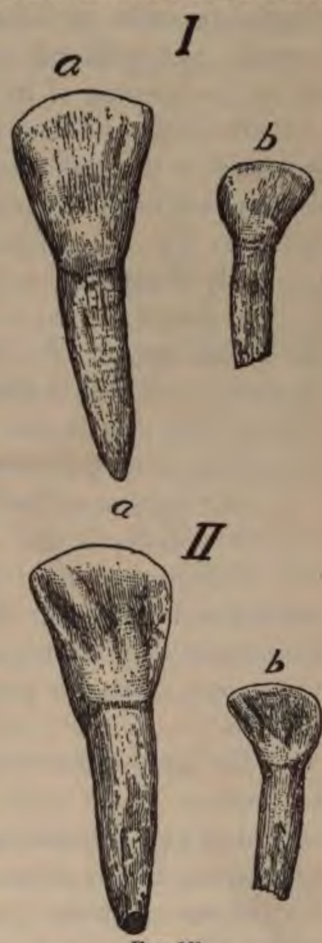


FIG. 160.

Left pincher teeth of the ox. I. External faces. II. Internal faces. *a a*. Permanent incisors. *b b*. Temporary incisors. (Natural size.)

The external or under face is convex in both directions; it is of a milky-white color and is striped with little longitudinal ridges and gutters, which become polished smooth with age. The internal or upper face is almost flat, but has a conical elevation, the base of which is directed toward the free border with which it merges, while its sides are bordered by small gutters. The internal border is convex and the external border is concave, which gives the tooth a curved shape and which indicates the side to which it belongs. The root is rounded, conical, and yellow in color; its extremity, in a young tooth, shows the opening of the dental canal.

Structure.—The incisors have approximately the same structure as the tush tooth of a horse; they are composed of a dentine with the free portion covered by a continuous layer of enamel. The enamel is thickest on the external surface and gradually disappears on the root. In the young tooth there is a large, simple, dental cavity filled with the dental pulp; but as the animal gets older, a dark-yellow dentine is deposited until the cavity is filled up and the tooth ceases to grow. It is not pushed from its alveolar cavity, as the incisors of the horse are, as the free portion is worn away.

Like the horse, the ox has two sets of incisors,—the temporary or milk-teeth and the permanent ones. The milk-teeth are distinguished from the permanent ones from their being smaller and narrower; their enamel is thinner and more transparent and they are more curved to the side. Their roots are very short, and are pushed out by the replacing permanent incisors.

The incisor scarcely reaches its full development when it commences to be worn by its contact and constant friction with food and with the cushion of the upper jaw. The wearing commences at the anterior border and removes the enamel toward the posterior part of the upper face. When it has completely removed the conical eminence and the lateral gutters, the tooth is said to be *leveled* and the table is formed. From the almost horizontal direction of the incisor teeth, the wearing of their tables takes place in an oblique direction to their long axis.

The table at first is large, consisting of a plate of dentine surrounded by a border of enamel, and having in its centre a transverse line of dark yellow, made by the uncovered, later deposit of dentine in the pulp-cavity. As the tooth becomes smaller toward its root the table becomes smaller and narrower and the dental star becomes narrower, but it also becomes longer from in front to behind, until it forms a distinct square as it is exposed by its posterior face from the oblique leveling.

As the incisors are worn away they seem to separate from each other at the roots, for the narrower parts of the crowns are held apart by their cartilaginous beds, which do not atrophy as does the bone of the maxilla of the horse, when the narrow, wedge-shaped roots are almost driven from their alveolar cavities.

When the teeth are worn down to their roots the gum retracts and shows the yellow stubs, which are all that is left of the incisive arch. (Fig. 167, *b*.)

With the wearing away of the incisors the dental arch loses its regular curve and becomes depressed in the middle.

MOLARS.

The ox has, like the horse, six molars in each arch, on either side of each jaw. The arch is shorter, as the teeth are smaller. The first molar is very small and each one increases in size to the sixth; but there is such a marked difference in the size that the first three teeth occupy but the third of the arch, while the last three complete the posterior two-thirds.

In the ox the molars have the same compound arrangement of enamel as in the horse, filled up by dentine and surrounded by a layer of cement. The latter often exists in great quantity, and is of a rich yellowish color. There seems to be a greater difference in the relative density of the substances, and the ridges of enamel stand out in sharper points as the softer dentine becomes worn away.

As in the horse, there are three temporary molars and six permanent molars in each arch.

According to Girard, the first temporary molar appears from the sixth to the twelfth day, following the eruption of the second and third molars, which are sometimes through the gums at birth or appear immediately after birth.

The permanent molars make their appearance in the following order: Second molar from twelve to eighteen months; first molar from twenty-four to thirty months; third molar at thirty-six months; fourth molar at eighteen months; fifth molar at twenty-four to thirty months; and the sixth molar at three years or later. When the rudimentary molar (wolf-tooth) exists it appears about the tenth month, and is driven out of its alveolar cavity, with the appearance of the first permanent (fourth) molar, at the age of two years.

Simonds claims that the molars do not show in the calf at birth, and first make their appearance at the end of the first month. Simonds also differs slightly from Girard as to the eruption of the permanent molars, placing the appearance of the fourth molar at six months; the fifth at fifteen months; the sixth at two years. He evidently studied on very precocious cattle. Undoubtedly the eruption of the molars in cattle is variable, and, owing to the trouble of examination in the living animal, its careful study has been neglected.

An annexed table shows the diversity of eruption in various subjects. It will be found to vary somewhat, not only in the different races of cattle, but in the families of the same race which are reared under different climatic conditions and are nourished more or less liberally.

The periods of the animal's life, as indicated by the teeth, form the following natural divisions:—

1. Eruption of the temporary teeth.
2. Wearing of the temporary teeth.
3. Eruption of the permanent teeth.
4. Leveling of the permanent teeth.
5. Wearing away of the crowns.

TABLE OF ERUPTION OF THE TEETH IN THE OX.

	SIMONDS.		GIRARD.	OTHER AUTHORITIES.		AVERAGE AUTHOR.	
	Race and Other Causes Favoring Development.	Race and Other Causes Retarding Development.		Minimum.	Maximum.	In Precocious Animals.	In Common Animals.
TEMPORARY INCISORS.							
Pinchers . .			At birth.	Before birth.	3 days.	At birth.	At birth.
1st intermediate.			At birth.	Before birth.	5 days.	At birth.	At birth.
2nd intermediate.			5th to 9th day.	Before birth	12 days.	5 days.	12 days.
Corners . . .			13th to 19th day.	Before birth.	35 days.	12 days.	18 days.
MOLARS. 1st.	After birth.	1 month.	6th to 12th day.	At birth.	1 month.	6 to 12 days.	18 to 30 days.
2nd.	At birth.	Earlier.	Earlier.	At birth.	Few days.	At birth.	After birth.
3rd.	At birth.	Earlier.	Earlier.	At birth.	Few days.	At birth.	After birth.
PERMANENT INCISORS.							
Pinchers . .	1 y. 9 m.	2 ys. 3 m.	19 to 21 months.	15 mos.	2 ys. 3 m.	1 yr. 6 m.	20 mos.
1st intermediate.	2 ys. 3 m.	2 ys. 9 m.	2½ to 3 years.	2 ys. 3 m.	3 years.	2 ys. 3 m.	2 ys. 9 m.
2d intermediate.	2 ys. 9 m.	3 ys. 3 m.	3½ to 4 years.	2 ys. 9 m.	4 years.	3 years.	3 ys. 6 m.
Corners . . .	3 ys. 3 m.	4 ys. 9 m.	4½ to 5 years.	2 ys. 10 m.	5 years.	3 ys. 9 m.	4 ys. 6 m.
MOLARS. 1st.	2 ys. 6 m.		2½ to 3 years.	2 ys. 3 m.	3 years.	2 ys. 6 m.	
2d.	2 ys. 6m.		12th to 18th month.	1 yr. 6 m.	2ys. 6 m.	1 yr. 6 m.	
3d.	3 years.		3 to 4 years.	3 years.	4 years.	3 years.	
4th.	6 mos.		18 months.	6 mos.	1 y. 6 m.	1 yr. 6 m.	
5th.	1 y. 3 m.		2½ to 3 years.	1 yr. 3 m.	3 years.	2 years.	
6th.	2 years.		3 to 4 years.	2 years.	4 years.	2 ys. 6 m.	

DETERMINATION OF AGE BY THE TEETH.

With the young calf to be slaughtered for veal the absolute age is usually less important than its condition of development and its weight, but may be the cause of serious legal question and require the most acute perception on the part of the expert to decide and testify in controversies between the suspected butcher and the rigid law.

FIRST PERIOD—ERUPTION OF THE TEMPORARY TEETH.

The calf is sometimes born with no incisors; but usually the pinchers and first intermediate teeth have pierced through the gums. The second intermediate teeth appear about the tenth day, and the corner teeth seven to ten days later, but may appear as late as the thirtieth day. The incisors do not reach the same level and complete the arch until the fifth or sixth month. (Fig. 161.)

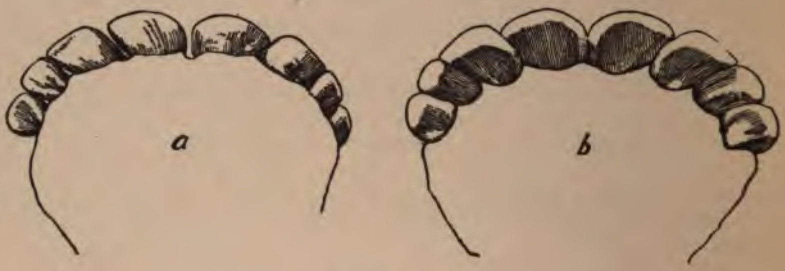


FIG. 161.
Incisors of the calf. *a*, external face. *b*, internal face.

SECOND PERIOD—WEARING OF THE TEMPORARY TEETH.

The leveling of the milk-teeth is very variable, according to the food on which the calf is fed. In calves fattened for the butcher with milk the wearing is slow, while in those that are put early to pasture and are fed on dried forage the leveling takes place much more rapidly. The pinchers are worn at their anterior borders at six months and are leveled at ten months; the arch is broken in the centre and loses its continuity at the first intermediate at one year, second intermediate at fifteen months, and at the corner teeth at eighteen to twenty months.

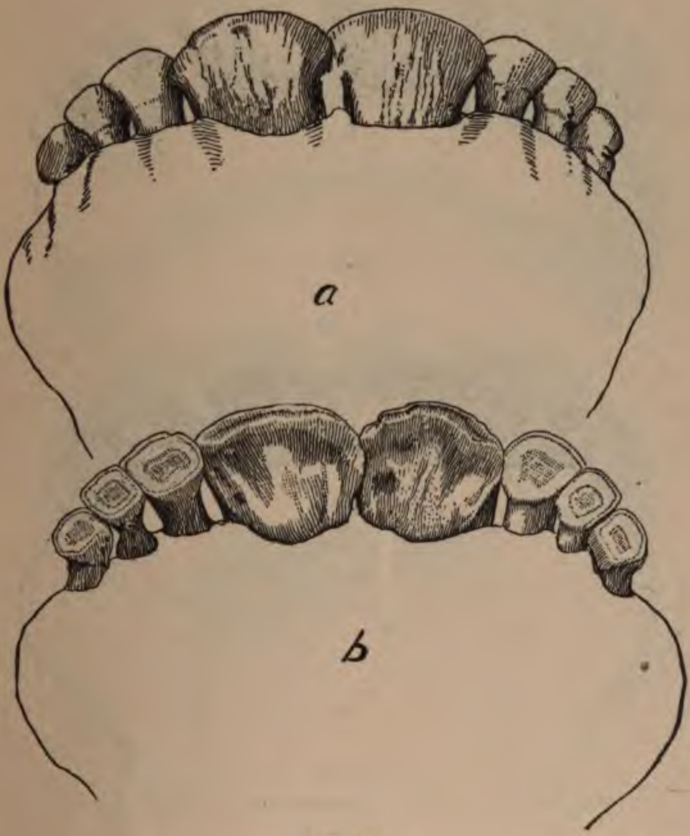


FIG. 162.
Two years. *a*, external face. *b*, internal face.

THIRD PERIOD—ERUPTION OF THE PERMANENT INCISORS.

Twenty Months.—At this time the milk-pinchers are replaced by the permanent ones, which protrude somewhat obliquely, but soon assume their natural position and are in place at two years. (Fig. 162.)

The crowns of the permanent pinchers, in this mouth, have not become quite free from the gums; the left-hand tooth is somewhat in advance of the other, and its enamel just shows traces of use.

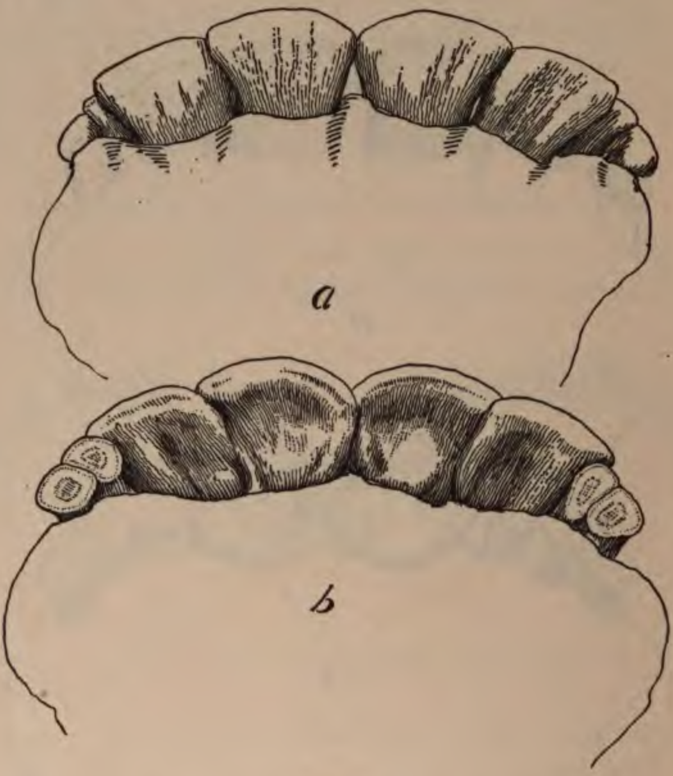


FIG. 163.
Two years, nine months. *a*, external face. *b*, internal face.

Two Years, Six Months.—Between two and one-quarter years to two years and nine months the first permanent intermediate teeth have accomplished their eruption. (Fig. 163.)

In this mouth the crowns of the first intermediate teeth are free from the gums, and the root of the second intermediate (temporary) is pressed on and its position slightly displaced.

Three Years, Three Months.—Between three years and three and one-half years the second intermediate have replaced the milk-teeth. (Fig. 164.)

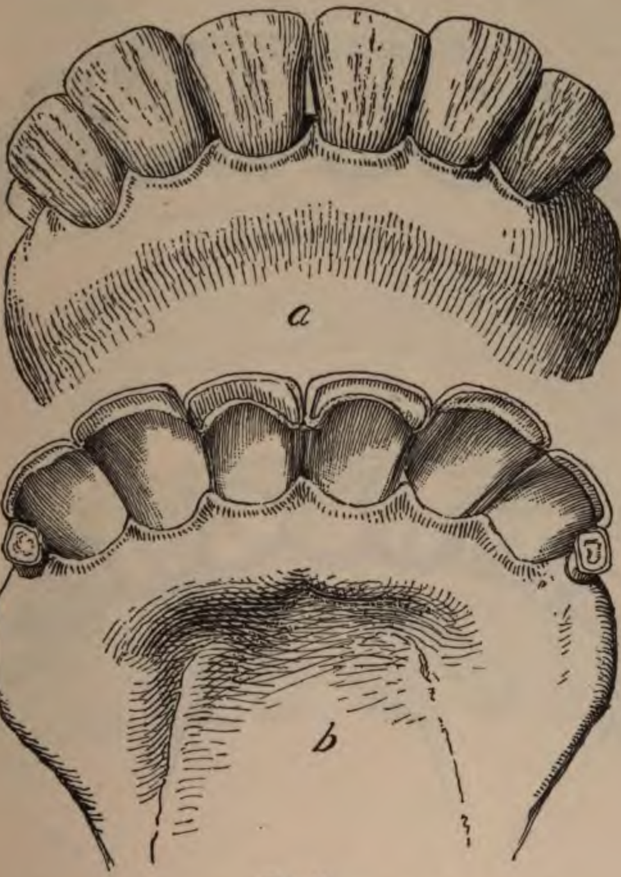


FIG. 164.
Three years, six months. *a*, external face. *b*, internal face.

In this mouth the second intermediate teeth have reached the level of the incisive arch and their enamel has commenced to be used.

Four Years.—Between three years and nine months and four years and six months the corner teeth are completely through the gums and the mouth is complete. (Fig. 165.)

The permanent corner teeth have just replaced the temporary ones, and are still in an oblique position, not having completely emerged from the gum.

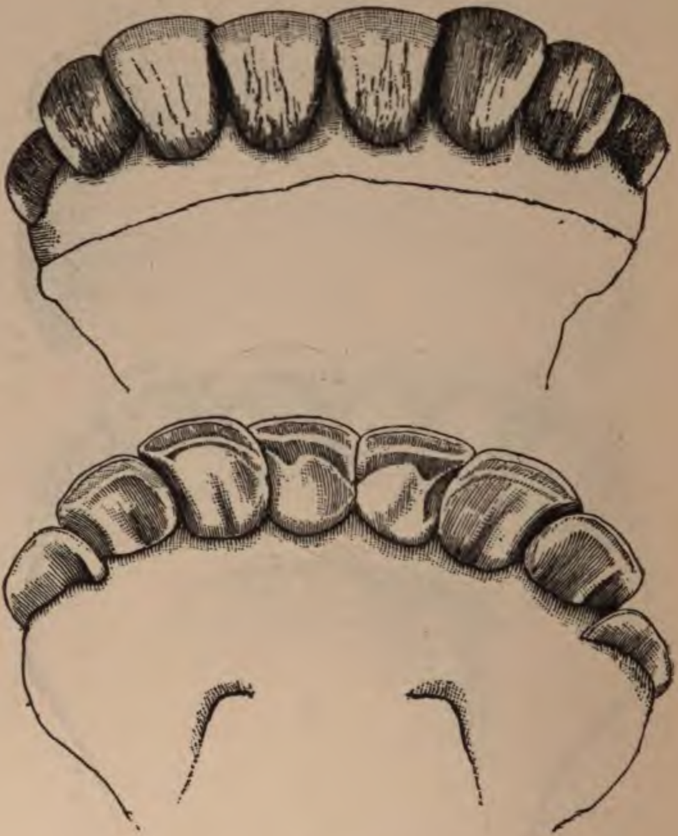


FIG. 165.
Four years. *a*, external face. *b*, internal face.

FOURTH PERIOD—LEVELING OF THE PERMANENT TEETH.

At five years the pinchers have commenced to level.

At six years the pinchers are leveled, both pairs of intermediate teeth are nearly so, and the corner teeth are somewhat worn. (Fig. 166, *a*.)

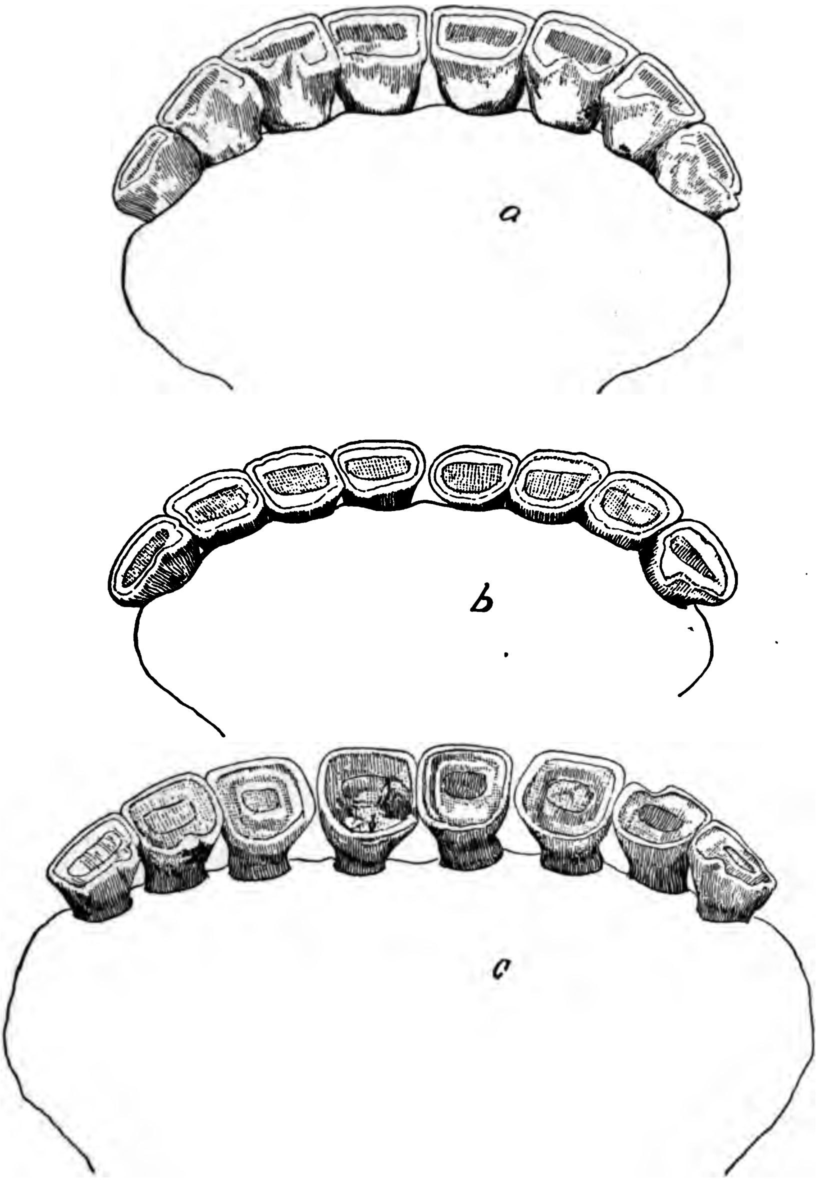


FIG. 166.
a, six years. *b*, eight years. *c*, ten years.

At seven years the first intermediate teeth are leveled, the second intermediate are much worn, and the corner teeth have lost their enamel at the anterior extremities.

At eight years the entire tables are leveled and the pinchers commence to show a concavity, which corresponds to a convexity of the cushion of the upper jaw. (Fig. 166, *b.*)

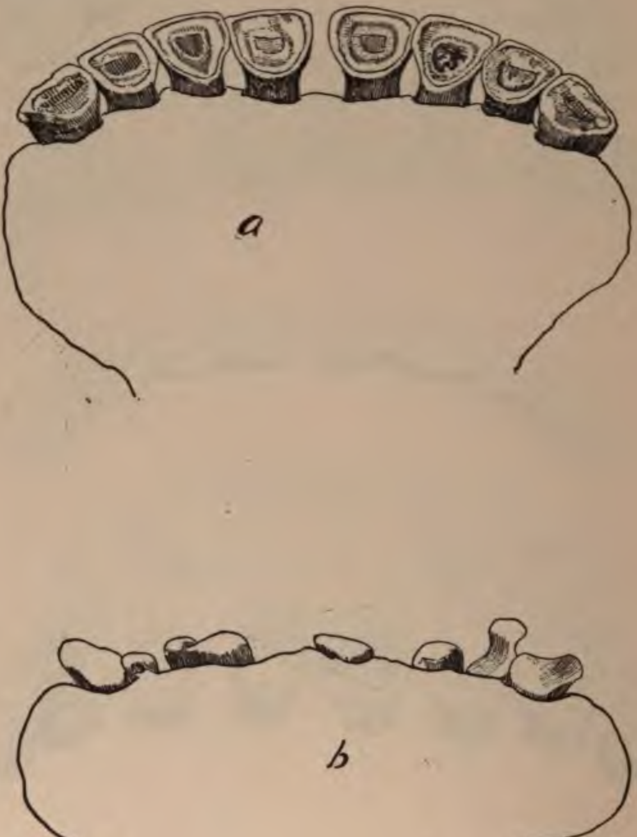


FIG. 167.
a, eleven years. *b*, fifteen years.

At nine and ten years this concavity extends to the intermediate teeth, the table of the pinchers is almost square, and the dental star of the pinchers and first intermediate teeth has become long and distinct. (Fig. 166, *c.*)

During this period, from six to ten years, the rounded arch formed by the incisors gradually loses its convexity until it almost forms a straight line. The teeth appear to separate, and the gum shows between them.

FIFTH PERIOD—WEARING AWAY OF THE CROWNS.

From this time on there is a progressive change in the shape of the teeth; the crowns become worn down with more or less rapidity, they diminish in size, the dental stars become larger and square, the teeth seem to separate, and the retracting gum leaves the yellow roots uncovered.

At ten years the dental star is square in the pinchers, and the first intermediate and the corner teeth are leveled.

At eleven to twelve years the dental star is square in all of the teeth, which become triangular in shape and commence from this time on to be worn to stubs. (Fig. 167, *a.*)

It must always be borne in mind that the race of the animal and the character of the food produce great variations in the wearing of the teeth. Animals fed on hard forage and those fed on brewers' grains will have their teeth worn down much more rapidly than those fed on the prepared food of the ordinary dairy.

DETERMINATION OF AGE BY THE HORNS.

The horns of cattle, rising more or less gracefully from the frontal bones, were undoubtedly intended for weapons of offense and defense. All breeds of cattle are provided with horns, except that known as the angus or polled angus, which was indigenous to the northern part of Great Britain from the earliest historical times, but of which we have no trace in prehistoric deposits. Among all varieties of cattle individuals may be devoid of horns; they are known as "mulley," or, if deprived of their horns artificially (dehorned-dishorned), are called "polled."

Polling has been done by the Hindoos for over the last two thousand years, without ever showing trace of producing hereditary results.

The horns are symmetrical in shape, and when there is any noticeable difference in the length, size, or curve of the horns, it may be assigned to some previous injury, disease, or accidental cause.

According to the character, habits, and surroundings of the various races and individuals, we find the horns more or less modified in size, shape, and strength.

In the semi-wild races, like those of Asia, Hungary, Spain, Texas, and South America, the horns may attain enormous size,—five feet in length; while in the most civilized, domesticated races, like the Durham, Dutch, and Channel-Island cattle, the horns tend to diminish in size, and may be but a few inches long.

The bull has strong, stout, short, straight horns, dense in structure, which seem to be as much points of hold for his massive, heavy head as actual weapons in times of warfare; the female has longer, sharper, more delicate horns, designed to use in emergencies. The steer has horns which are a compromise between those of the two sexes,—longer than those of the bull and larger than those of the cow.

The horns have for a basement two *cores*, or conical, bony projections of porous structure, richly supplied with blood-vessels, and containing air-cells which communicate with the sinuses of the frontal, occipital, and maxillary bones.

The cores are covered by a dense, fibrous, vascular membrane, from the outer face of which, corresponding to the chorion of the skin, the horns grow. The horns themselves are conical tubes more or less curved, consisting of concentric layers of epithelial growth.

Soon after birth the calf shows two little, hard, rounded points at either side of the frontal bone, which slowly emerge from the skin. At eight or ten days the point is through the skin and shows the color which the horns will have later; at three weeks a distinct little flexible horn has appeared. At five or six months the horn has commenced to curve on its long axis and assume the direction it will have later. Up to this time, and during the first year, the horn is covered by an epidermic prolongation of the skin, similar to the covering of the hoof of the foal at birth, but by the twelfth to fifteenth month this covering has dried and scaled off, leaving the natural, shining, tough surface of the horn proper.

In the second year the horns start a fresh growth, and a small groove is found encircling it between the substance secreted the first year and that which developed in the second.

During the third year a similar activity in growth takes place, and a second groove is found marking the line between the two years' growth. These two grooves or circular furrows around the horn are not well marked and have been frequently overlooked, and all trace of them disappears as the animal becomes older.

From three years on, the growth of the horn is marked by a groove or furrow, much deeper and so distinct that they show between them a decided elevation or " ring " of horny substance, which forms an accurate basis for estimating the age of the animal. In an animal over three years of age we count all of the horn beyond the first groove as indicating three years, and add one year to its age for each groove and " ring " which is present toward the base of the horn.

The grooves are always better marked in the concavity of the horn than on the convex surface. In feeble, ill-nourished animals they are but slightly marked.

Many causes, however, tend to diminish the value of the " rings " and grooves in the estimation of age. In " show " cattle and in herds of cattle kept for show, the horns are frequently sand-papered, scraped, and polished to give them the fine appearance of delicate texture, which, with that of the other integument, indicates the similar condition of the mammary gland for secreting milk and of the connective tissue for forming fat. Dealers scrape the horns to destroy the evidences of age in the animals which they have for sale. In old cows there is an atrophy of growth and an apparent contraction of the base of the horn; the rings and grooves are much less distinctly marked and may be indistinguishable.

In the first four years the teeth are the most valuable indications of age, from four to ten years the horns furnish the more accurate signs, and after ten years a careful comparison of both is required to determine approximately the number of years which have passed.

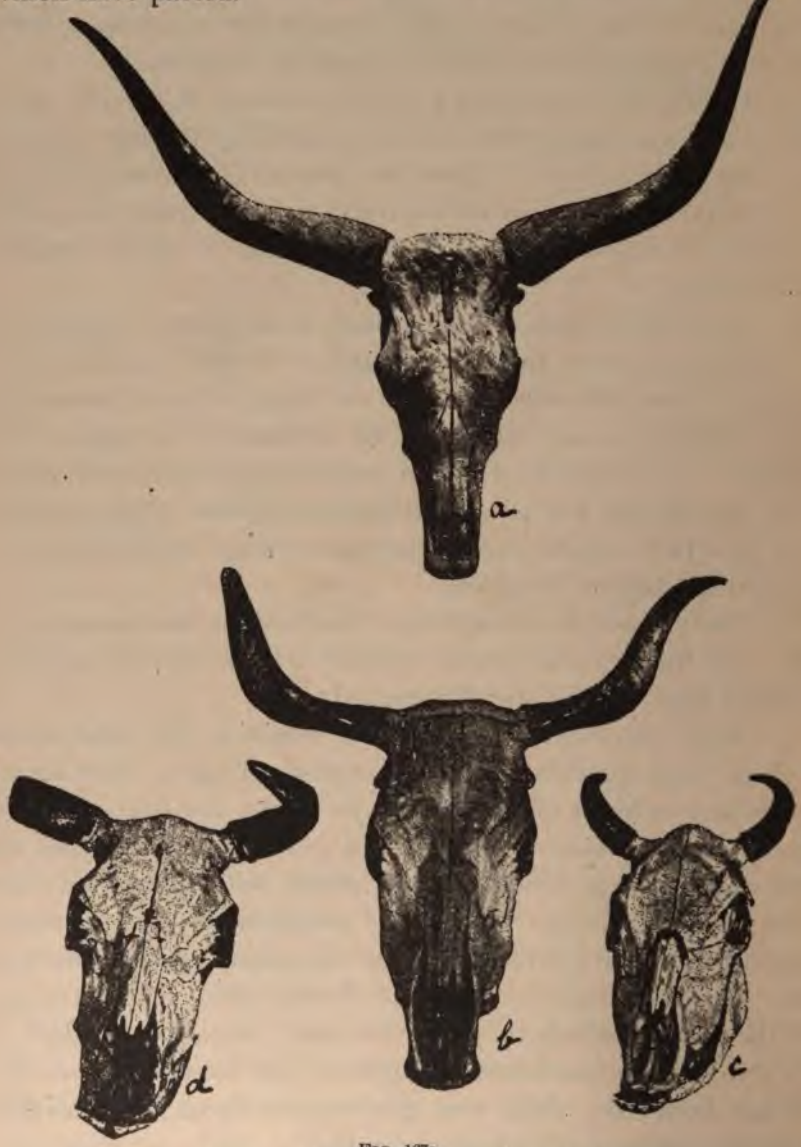


FIG. 167a.
Form of horns. *a*, Hungarian; *b*, Jura; *c*, Jersey; *d*, Durham.

AGE OF THE SHEEP AND GOAT.

The sheep is of value for any purpose for a still more limited period than the ox, and its exact age is of less importance, except in the case of valuable breeding animals, which are always possessed of a registered pedigree which guarantees the day of their birth. An approximation within a month or two is sufficient for practical purposes in a spring lamb, and an error of six months will not alter the taste of a four-year-old South-Down wether for a roast saddle. After this time it is a poor economist, except in districts where wool is the only product to be derived from the sheep, who will not turn it over to the butcher,—again excepting the pedigreed breeding animal. Civilization, better agriculture, and the care of man have altered the physiological characters of the ovine races even more than they have those of the bovine, and a larger percentage of the former have been rendered precocious than of any other species of animal. As a result of the improved agricultural needs, the sheep has altered considerably in form; the eruption of the teeth is more hasty, the horns have diminished in size or are absent, and the general shape of the animal has been modified.

The age of the sheep is determined by the character of the teeth, and of the horns, when the latter are present.

DENTITION.

$$\text{Formula}\begin{cases}\text{Temporary,} \quad . \quad . \quad . \quad . \quad . & \dfrac{0\,.\,0\,.\,3}{4\,.\,0\,.\,3}=20\\[2ex] \text{Permanent,} \quad . \quad . \quad . \quad . \quad . & \dfrac{0\,.\,0\,.\,6}{4\,.\,0\,.\,6}=32\end{cases}$$

The sheep has thirty-two teeth, like the ox,—eight incisors in the lower jaw, none in the upper, six molars in each arch of either jaw, making twenty-four molars in all, and no tushes.

INCISORS.

The incisors are eight in number. They are set firmly in their alveolar cavities in the maxilla, and form an arch more convex than either the incisive arch of the horse or the ox. As in the ox, they are termed the *pincher*, *first intermediate*, *second intermediate*, and *corner* teeth. As in the other animals, there are two sets, the *temporary* incisors and the *permanent* incisors. The temporary incisors are much smaller and proportionately much narrower than the permanent ones; so that the jaw of the lamb has an elongated, narrow appearance, which alters greatly in form, becoming wider and more flat in the older animals. The incisors of both dentitions are wedge-shaped like the permanent incisors of the horse. They have no neck separating the crown from the root, like the incisors of the ox and the temporary incisors of the horse. They are firmly imbedded in their alveolar cavities, which allows them to nip the short grass close to the roots and obtain a living, where the ox, with its loose incisors, can no longer obtain a hold to tear up the blades.

In the virgin tooth the external face is white and polished except near the root, where it is surrounded by a black cement. The internal face has two longitudinal gutters divided by a little crest. The gutters are filled with black cement. They represent by their convex anterior face, in profile, the quarter of a circle. From this position they meet the cushion of the upper jaw by their free extremity, like the incisors of a young horse, and not by the posterior surface, as in the ox; so that by use they rapidly wear the anterior border and form a table to the teeth like the soliped, and not like that of their closer relation, the large ruminant. The incisors of the sheep are formed of dentine, surrounding a pulp-cavity which becomes filled with a darker-colored deposit at an early period, and are covered with a layer of enamel, which disappears toward the roots, and which is covered on the sides, in the longitudinal gutters, and near the gums by a black cement.

MOLARS.

The molars, except for their smaller size, resemble those of the ox. They gradually increase in size from the first to the sixth molar, the first three occupying but a third of the arch. The relative density of the dentine and the convoluted enamel differs greatly, so that the dentine is more rapidly worn and the enamel stands in sharp ridges from the table of the teeth.

ERUPTION OF THE TEMPORARY TEETH.

INCISORS.

Considerable diversity of description is found among the older writers as to the time of eruption of the teeth in the sheep from the fact that some studied them in the common races of Central Europe, while others examined them only in the perfected races of England. At the present day the studies of the latter will be found more accurate, as few flocks can be found which are not well bred or mixed more or less with the finer races.

At birth, the lamb may have the pinchers and first intermediate teeth through the gums, or the anterior borders of these teeth may show a whitish line where they press against the gum, which they pierce in from three to five days. The second intermediate emerges from the gum about the tenth day, and is followed tardily by the corner teeth, which do not appear until the twenty-eighth or thirtieth day.

MOLARS.

The three temporary molars in each arch appear about the third week, when we find the first six incisors sufficiently advanced from the gums to allow the young animal to nip herbage, which is to be ground by the larger teeth.

ALTERATIONS DURING THE FIRST YEAR.

One to Three Months.—During this time there is little change in the teeth. They are slightly more prominent, but retain their virgin appearance.

About Three Months.—Sometimes just before and sometimes just after three months from the birth of the animal the fourth (first permanent) molar appears, that of the lower jaw preceding that of the upper by a week or more.

Three to Nine Months.—During this half-year no characters of substantial value can be found. The incisors during this period attain their full size, and, according to the herbage or other food on which the animal has been fed, more or less wearing of the anterior borders of the teeth has taken place. In addition, however, to the general aspect of the animal, it is easy to recognize the difference between the fresher teeth, which have scarcely been worn, of a lamb four to five months of age, and the worn, broken, and loosening ones at eight, nine, or ten months.

Nine Months.—At nine months the fifth (second permanent) molar makes its eruption. This fixes an important land-mark in the determination of the age of the young animal.

The fourth and fifth molars are formed of two principal lobes, each with two points of enamel, so that there are four points of enamel; the internal points are higher on the lower teeth, while the external ones are longer on the upper teeth. These points become used, and as they are worn away the band of central enamel is separated from the outer border of the teeth by a larger area of dentine.

The character of the points of enamel on these teeth, or the distance of the bands of enamel from the outer border of the teeth, thus indicates whether the animal has just passed nine months or is a year or more old.

Ten Months.—At about ten months the body of the maxilla is seen to be wider and broader,—due to the development of the permanent pinchers, which press upon the roots of the temporary pinchers, producing absorption, and these latter are found less solidly fixed in their alveolæ.

ERUPTION OF PERMANENT TEETH.

One Year to Fifteen Months (Fig. 168, I).—At this period the permanent pinchers make their appearance. In the more

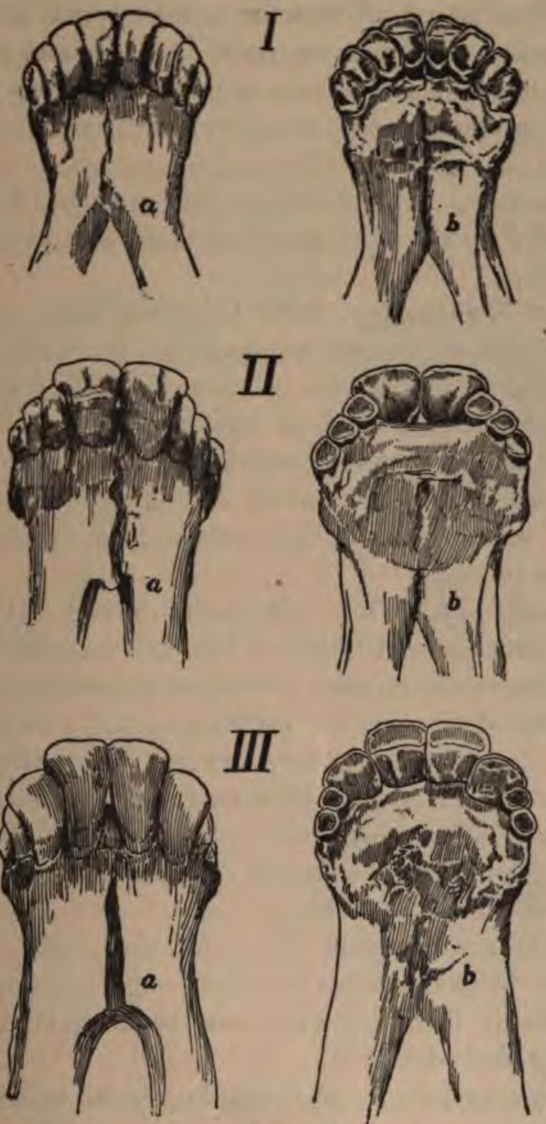


FIG. 168.
I, one year. II, eighteen months. III, two years, three months. *a*, external face. *b*, internal face.

precocious races the eruption of the pinchers takes place at one year, while in the common races it may not until fifteen months. Again, a question of individual development may hasten or retard the eruption by a month or two; so that the better-bred animal may be thirteen or fourteen months before the first two permanent teeth have appeared, while the more hasty, common animal may have its permanent teeth by the same time. In the male the eruption takes place very slightly earlier than in the female.

The conditions of the points on the fourth and fifth molars already alluded to will aid in deciding if the eruption has been hasty or tardy.

Eighteen Months (Fig. 168, II).—At a year and a half the first intermediate permanent incisors and the sixth permanent molars appear. The eruption of these teeth is followed very shortly by the falling out of all the temporary molars, which are replaced almost simultaneously by the permanent molars. After two years the molars furnish but little indication of the age. From this time, according to its sex, the lamb takes the name of *ram* or *ewe.*

Two Years and Three Months (Fig. 168, III).—About nine months after the eruption of the first intermediate teeth the second *intermediate* appear; whether in precocious or tardy races, the interval between the eruption of the first and second intermediate teeth is some three months longer than that between the former and the pincher teeth. In tardy animals, in which the first intermediate have not appeared until they are nearly two years of age, the second intermediate may be delayed until two years and nine months.

Three Years (Fig. 169, IV).—At three years the eruption of the corner teeth takes place, although under the conditions given above certain animals may be several months late in completing their dentition.

A greater irregularity is found in regard to the appearance of the corner teeth than in the sequence of eruption of the others. By the time of the appearance of the corner teeth the pinchers and first intermediate may become worn and even leveled. Girard first noted that some sheep have but six incisors, the corner teeth remaining aborted under the gum.

After four years (Fig. 169, V) there is a continuous but very irregular wearing of the teeth, which is governed by the nature of the food. Those animals which are fed on fine herbage and those which are stall-fed level off the tables evenly until but stumps remain ; but in all sheep there is always more rapid wearing of the pinchers and first intermediate teeth, which gives the plane of the tables of the arch a concave form.

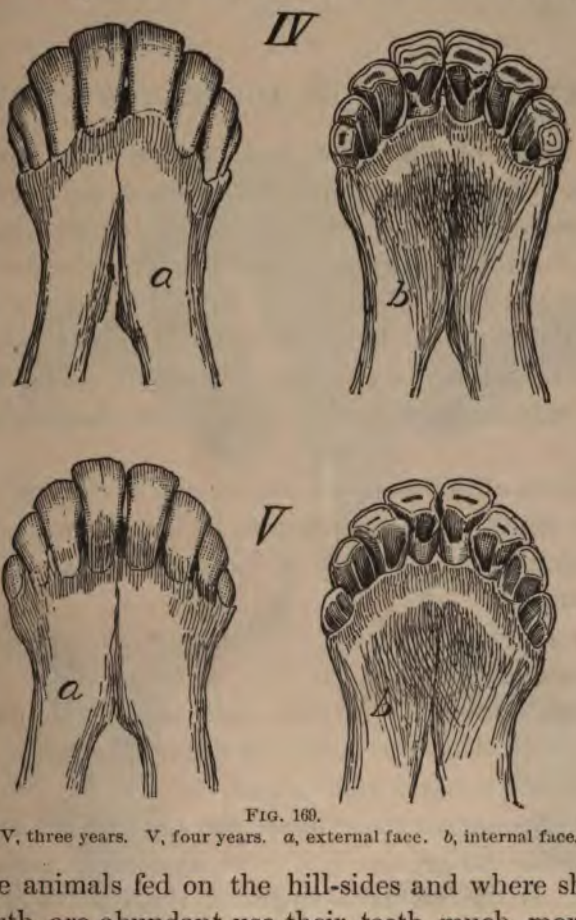


FIG. 169.
IV, three years. V, four years. *a*, external face. *b*, internal face.

Those animals fed on the hill-sides and where shrubs and undergrowth are abundant use their teeth much more rapidly, and wear notches between them like the markings on a horse which cribs on a vertical object ; these notches are called, very appropriately, by the French agriculturists, *swallow-tails* (*queue d'hirondelle*).

As age advances the teeth of the sheep are worn to stumps; they become black and loose in their alveolar cavities.

In the old animals the face wrinkles, the lips become thick, and the muzzle, which was fine and pointed in the lamb, becomes enlarged and broad. Sometimes in old sheep, but more frequently in old goats, the incisors attain a great length; the incisive arch is, however, in these cases usually broken and irregular.

DETERMINATION OF AGE BY THE HORNS.

The horns of the ovine and caprine races are variable ornaments. Some races have horns, some do not; in some races the male has horns and the female none, while in the others the female has very small, aborted apologies for them. In the long-wooled English sheep the horns are absent; the merinos originally had the magnificent typical "ram's horn," which has become a descriptive of shape, but domestication has gradually reduced them in size, and in some families they abort entirely.

The horn of the sheep grows up, out, back, and gradually turns on a central axis, according to its length, in the form of a conical corkscrew. The horn of the goat grows up, back, and slightly outward.

In structure and growth the horns of the sheep and goat are like those of the ox. The horn of the sheep is flat on its inferior surface and convex from side to side on its superior surface; it is divided transversely by ridges; the interspaces have longitudinal scaly ridges and gutters.

The horns appear about fifteen days after birth, attain their greater growth during the first year, and cease growing after four years. If the animal is castrated the growth of the horn lessens, whereas in the ox castration stimulates the growth.

The epidermic covering, which extends from the skin on the appearance of the horn, dries and scales off in six weeks to two months, leaving a roughened, scaly surface. The size and roughness of these series of scaly sections vary from year to year, and indicate the years until the horns cease to grow,—at four. Observations by Girard on the growth of the horns of merino rams (the horns of the merinos are the most typical) showed the growth to be:—

The first year,	19 to 20	inches.
The second year,	5 to 6	"
The third year,	3 to 4	"
The fourth year,	2 to 3	"
	29 33	"

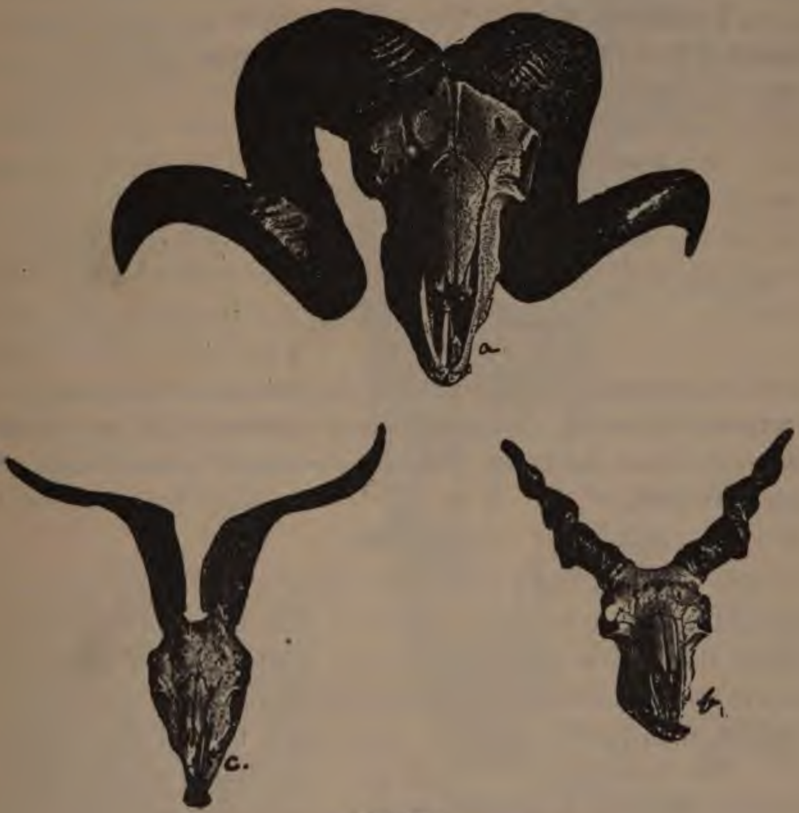


FIG. 169a.
a, Merino ram; *b*, Montenegrin ram; *c*, goat.

AGE OF THE HOG.

The age of the hog is of much less importance than that of any of the domestic animals, as this animal becomes an article of commerce and is sent to the butcher the moment that the ratio of its increase of weight (flesh and fat) ceases to be greater than the proportionate cost of the food which is furnished to it. Even for breeding purposes, the hog is rarely kept to an advanced age. The question of its age only becomes important in exhibitions, where the judges must verify the age in the class for which the animal is entered.

DENTITION.

$$\text{Formula}\begin{cases}\text{Temporary,} \quad . \quad . \quad . \quad . \quad . \quad \dfrac{3\,.\,1\,.\,3}{3\,.\,1\,.\,3}=28\\[2ex] \text{Permanent,} \quad . \quad . \quad . \quad \dfrac{3\,.\,1\,.\,4\,.\,3}{3\,.\,1\,.\,4\,.\,3}=44\end{cases}$$

The hog has forty-four teeth,—six incisors in each jaw (12), two tushes in each jaw (4), and seven molars (which are subdivided into four premolars and three molars) in each arch of both jaws (28).

INCISORS.

The pinchers and intermediate teeth of the upper jaw are flattened from side to side, somewhat like those of the horse, as they also have a small dental cup; while those of the lower jaw are straight, rounded, and directed forward like the teeth of a rodent, with their extremities converging toward the median line. The corner teeth of both jaws are small, conical teeth, separated from the intermediate on the one side and from the tusks on the other. They have no cups, but often have three small tubercles like the incisors of the dog.

TUSKS.

The tusks are much more developed in the male than in the female; they are prismatic in shape and curve outward and backward. In the wild hog they may attain an enormous length (six inches or more), pressing the upper lip upward and the lower lip downward and crossing each other in an **X**, the superior tusk passing behind the inferior; the two frequently have their respective anterior and posterior faces much worn by the constant friction from their contact with each other. The tusks continue to grow during the life of the animal. The growth is diminished in the castrated male.

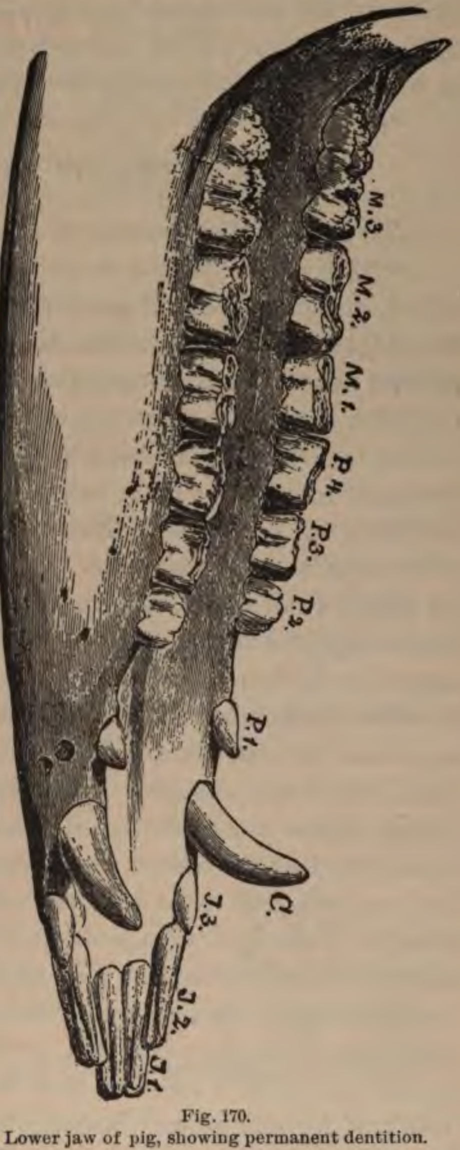


Fig. 170.
Lower jaw of pig, showing permanent dentition.

MOLARS.

The molars are divided into premolars and post-molars. The first premolar resembles very much the conical corner incisor tooth, but has two roots instead of one. It is placed in the interspace between the tusks and the other molars, being about twice as far from the latter as from the former.

The other molars are between the inferior molars of the horse and the molars of the dog in form. They wear by the centre of the crown and have not the irregular asperities found in the herbivora. They increase gradually in size from in front to behind, and are larger in the upper jaw than in the lower.

DETERMINATION OF AGE BY THE TEETH.

To Dr. Olof Schwartzkopff I am indebted for the following:

"During the past few years many objections have been raised, on the part of our practical breeders, to the correctness of the older rules for recognizing the age of our domestic animals. Several cases of an extraordinarily early development of the dentition have been observed in fat-stock shows and other exhibitions, and it has been alleged that modern feeding, with the tendency to produce early maturity, results also in an earlier shedding of the teeth. Not only in the United States have these doubts been heard, but also in England and Germany. In 1882 Prof. G. T. Brown published, in the *Journal of the Royal Agricultural Society of England*, an article in which he comes to the conclusion that, as a general thing, the views of the breeders cannot be relied upon, and that the recognition of the age from the teeth is still the best and surest. In June, 1886, the Executive Committee of the Fat-Stock Show at Berlin preferred similar complaints, and requested the Minister of Agriculture to introduce new experiments at the veterinary schools and agricultural experiment-stations in Germany, to ascertain whether the signs of age from dentition, sexual development, and growth of horns can appear at an earlier time in our precocious breeds than hitherto believed. Accordingly, Prof. A. Nehring, of Berlin, published, in the *Landwirtschaftliche Jahrbucher* of 1888, a series of new dentition tables for pigs, as a result of his studies and investigations upon a collection of one hundred and thirty-one skulls of different kinds of pigs, at the Museum of the Royal Agricultural School at Berlin.

"Having seen and examined parts of this collection, I will undertake to demonstrate, with the guide of the tables me tioned, together with my own experience and observation whi practicing in breeding establishments, that our practical men hav been quite right in many cases, and that the doubts to whic reference has been made are not without foundation."

The pig, like the other animals, has two sets of teeth,—the temporary or milk teeth and the permanent ones.

"There exists a remarkable difference in the time occupied by the teeth in cutting their way through the gum and appearing on its surface, while the mode of succession remains unchanged. But it must be remembered that the dentition tables, still referred to in modern books for the practical pig-breeder, are based upon observations made in times when the common pig was raised, or, perhaps, a breed more or less improved by English stock, and fed in the old-fashioned style. Variations into early maturity were then described as abnormal; but as soon as the pure breeding of the favorites of our day commenced, Berkshire, Poland China, *et al.*, and we applied to them scientific feeding, we forced the animals into entirely new and artificial conditions, revealing the hitherto unknown physiological laws of early maturity."

The periods of age which can be determined by the dentition are divided as follows:—

1. Eruption of the temporary teeth.
2. Eruption of the permanent teeth.
3. Wearing of the permanent teeth, after two and a half or three years,—an age attained but by few animals.

These periods vary slightly, and when a latitude of time is given it is understood that the shorter is for precocious pigs and the longer for those races which approach the primitive pig.

FIRST PERIOD—ERUPTION OF THE TEMPORARY TEETH.

At Birth.—The pig is born with eight teeth,—the corner incisors of each jaw and the tusks. These teeth resemble each other very much, and probably serve to aid the tongue in sucking.

Four to Fourteen Days.—In the first two weeks the second upper molar and the third lower molar appear.

Two to Five Weeks.—During the next three weeks the second lower molar, the third upper molar, and the pinchers of both jaws accomplish their eruption.

Five Weeks to Three Months.—At about six weeks the intermediate incisors of the lower jaw appear, which are followed in two weeks by the intermediate incisors of the upper jaw.

Three Months.—At three months the eruption of the temporary teeth is completed, and during the next few months the teeth become more or less worn, according to the character of food upon which the animal is nourished.

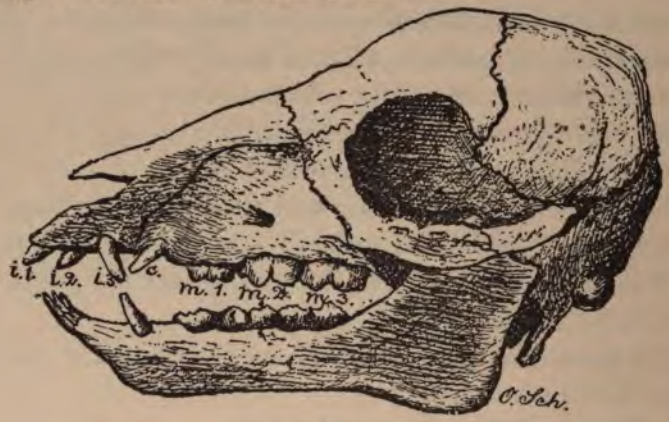


FIG. 171.
Skull of a three-month-old pig with full milk dentition.

SECOND PERIOD—ERUPTION OF THE PERMANENT TEETH.

About Six Months.—Before the first half-year the first permanent molar (fifth) and the first premolar (wolf-tooth) in each jaw appear.

Nine Months.—Within a month of three-quarters of a year the corner incisors and the tusks make their eruption, followed shortly by the second molars (sixth) of both jaws.

One Year.—At one year the lower pinchers protrude from the gums, preceding the superior pinchers by two to three months. At about this time, thirteen to fourteen months, the third and fourth premolars appear, followed a month later by the second premolar.

One and a Half Years.—At eighteen months the intermediate incisors of both jaws make their appearance, and simultaneously the eruption of the third molar (seventh) takes place.

After Two Years.—After two years the incisor teeth become used with great irregularity, according to the nature of the food; the tusks increase in length and give some approximation of their age, but insufficiently to be accurate.

TABLE OF DENTITION OF THE HOG.

MILK DENTITION.

	SCHWARTZKOPFF.			SIMONDS.
TEETH.	PRECOCIOUS PIGS.	NORMAL TIME OF APPEARANCE.	PRIMITIVE PIGS.	NORMAL TIME.
Corners and tusks.	Present at birth	Present at birth.	. . . . .	At birth.
Pinchers	2 weeks.	3 to 4 weeks.	5 weeks.	1 month.
Intermediate:				
Upper jaw . . .	8 weeks.	12 weeks.	16 weeks.	3 months
Lower jaw . . .	5 weeks.	8 weeks.	12 weeks.	
1st molar	5 weeks.	7 weeks.	9 weeks.	
2d molar:				
Upper jaw . . .	4 days.	8 days.	14 days.	
Lower jaw . . .	2 weeks.	3 to 4 weeks.	5 weeks.	
3d Molar:				
Upper jaw . . .	2 weeks.	3 to 4 weeks.	5 weeks.	
Lower jaw . . .	4 days.	8 days.	14 days.	
PERMANENT DENTITION.				
Pinchers	11 months.	12 months.	14 months.	12 months.
Intermediate . .	16 months	18 months.	21 months.	18 months.
Corners	7½ to 8 months.	9 months.	10 months.	9 months.
Tusks	3½ months.	9 months.	10 months.	9 months.
1st premolar . . .	2 to 3 months.	5 months.	6 months.	
2d premolar . . .	13 months.	14 to 15 months.	16 months.	
3d premolar . . .	12 months.	13 to 14 months.	15 months.	
4th premolar . . .	12 months.	13 to 14 months.	15 months.	
1st molar	2 months.	5 months.	6 months.	
2d molar	7 to 8 months.	9 to 10 months.	12 to 14 months.	
3d molar	17 months.	18 to 19 months.	20 to 22 months.	

The following explanation of the causes influencing the variations in the dentition of the pig is given by Schwartzkopff:—

"The question now arises as to what may be regarded as the cause of this early dentition in modern pigs. We know that our present method of feeding causes a rapid development of the whole body, including, of course, the head. As the teeth could not possibly grow without a corresponding growth of the jaws that produce them, we must conclude that the development of the skull is the primary cause or driving force in their development. Unconsciously, the modern feeder has produced here some highly interesting facts instructive to natural science at large.

"Hitherto zoölogists have been of the opinion that the form of skull of a fixed species is unchangeable from generation to generation,—we may say for thousands of years. This is correct as long as we think of individuals raised in the freedom of nature and under natural and similar circumstances. But domestication, with its forced feeding and breeding for various demands, has brought about unexpected changes in many respects, and it is now evident that the form of skull does not rest merely upon heredity. Only a predisposition to a certain form of skull is transferable from parents to their offsprings, but whether exactly the same form will be transmitted depends to a greater extent upon the nutrition, and but little less upon the employment of the muscles of the head and neck. It is not only important that the nourishment be abundant and well selected, but it is also necessary that the individual be in a healthy condition, and his digestive apparatus in such working-order as to be able to utilize the offered food equally well. This is plainly seen by comparing skulls from animals which were healthy and growing vigorously with those which received the same advantages of nutrition, but were suffering with a chronic disease. Continued weakness, caused either by disease or insufficient food, produces a long, slender skull, while the skull from a strong pig shows a remarkable expansion in its latitude and altitude.

"The following reproductions, taken from originals in the agricultural museum at Berlin, will illustrate this point:—

"Besides the nutrition influence, a strong or weak muscular action plays an important part in the production of form. The pulling and pressure of muscles extensively used for certain purposes, especially those of the head and neck, will give the head a characteristic shape. Pigs which are prevented from rooting will acquire a short, high, and rounded head, while those which are forced to root to secure a portion of their food will develop a long and slender form of head. If we force both experiments to the greatest degree possible, we shall produce those extremes which distinguish the wild pig from our improved races. That this is true is proven by the fact that when our domestic hogs are returned to absolute liberty, it will require but a few generations to reproduce the original skull of the wild pig. And, *vice versâ*, we have called into existence, from the primitive hog, all those different representative types of our day by careful and continued selection, gradual assortment, and particular attention to the desired qualities of form, size, etc. The striking difference between the skull of a primitive hog and a modern one is seen in the following illustration:—

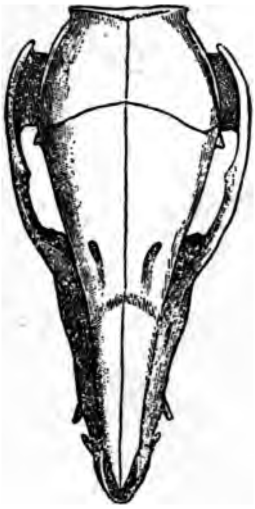


FIG. 172.
Skull of a three-month-old pig which died from tuberculosis. (Half natural size.)

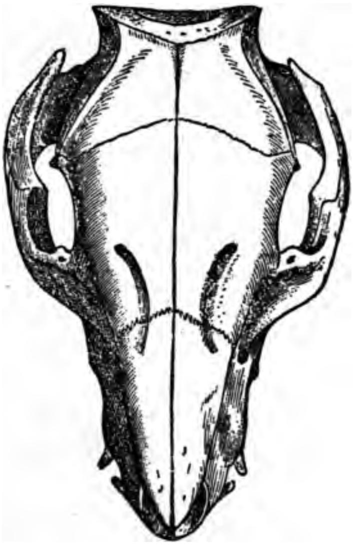


FIG. 173.
Skull of a two-month-old healthy and well-fed pig. (Half natural size.)

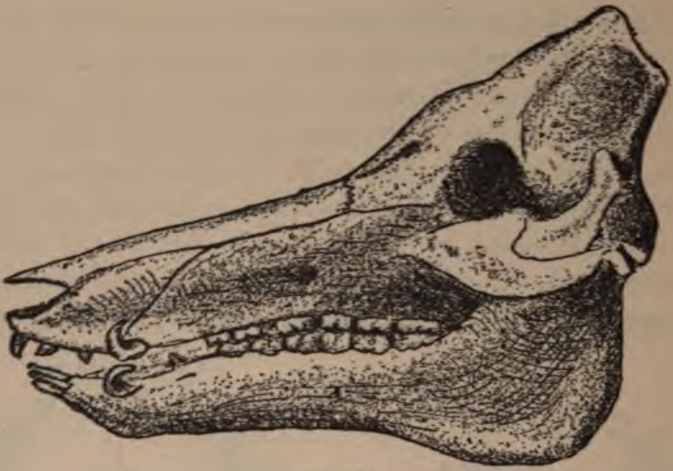


FIG. 174.
Skull of a full-grown primitive Texas boar.

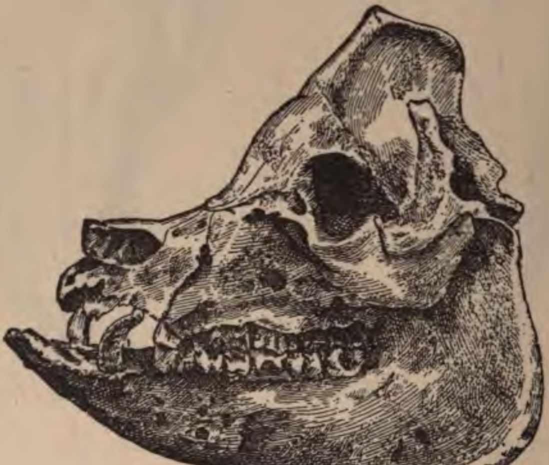


FIG. 175.
Skull of a full-grown sow of the small Yorkshire breed.

"The pig has, perhaps, the most elastic and changeable organization of any of our domestic animals. It also has the advantage of being able to digest all kinds of food as an omnivorous animal; and last, though not least, it multiplies more rapidly than any domestic animal,—even the sheep. Therefore, it has been at all times regarded, and properly too, as the animal *par excellence* for experiments in breeding, and the pig is the best example of what men have accomplished in the production of animals.

"Drawing, now, the conclusions from the above examinations, I shall summarize them in the following theses :—

"1. The order of succession of the teeth in our precocious pigs remains the same as in the primitive hog.

"2. The times when the teeth appear are variable, according to the race, feeding, and health. The same breeds, raised under the same conditions, will show the same appearance.

"3. The form of the skull depends upon nutrition, health, and more or less employment of certain muscles of the head and neck."

AGE OF THE DOG.

THE age of the dog is a matter of considerable importance. While the well-bred hunting-dogs, hounds, setters, and pointers, and those of other races which are kept for breeding purposes, have almost invariably a verified and registered pedigree, which is stereotyped on the end of the owner's tongue, with the date of the animal's birth, yet there are large numbers of dogs, especially of the races which are kept for house-dogs and pets, which, from their appearance, are of undoubted good breeding, but which, from change of owners by sale, theft, or in the many other ways peculiar to dogs, lose their records. In view of the great prices which these animals sometimes bring, it becomes needful to at least approximately determine their age, and to estimate the number of years which they still have to live and will be of use to their owners. The smaller races of dogs usually live to a greater age than the larger. The mastiff, St. Bernard, and Great Dane rarely exceed the age of ten years; the hound, setter, and pointer may live two or three years longer; and the terriers have been known to live to seventeen, nineteen, and twenty-two years of age.

DENTITION.

$$\text{Formula}\begin{cases}\text{Temporary}, \quad . \quad . \quad . \quad . \quad . & \dfrac{3\,.\,1\,.\,3}{3\,.\,1\,.\,4} = 30\\[2ex] \text{Permanent}, \quad . \quad . \quad . \quad . & \dfrac{3\,.\,1\,.\,4\,.\,2}{3\,.\,1\,.\,4\,.\,3} = 42\end{cases}$$

The dog has forty-two teeth,—twenty in the upper jaw and twenty-two in the lower. They are divided, like those of the other animals, into *incisors*, *tusks*, and *molars*, the latter again subdivided into *premolars* and *post-molars*.

INCISORS.

There are six incisors in each jaw, known as the *pinchers*, *intermediate*, and *corner* teeth. Those of the upper jaw are larger than those of the lower; the corner teeth are the largest, the intermediate are next in size, and the pinchers are the smallest. The incisor teeth have a large crown, on the extremity of which there are three eminences or tubercles, that in the centre being the largest, which gives it somwhat the form of a clover-leaf, or *fleur-de-lis*. The internal face is beveled off and separated from the root of the tooth by a distinct ridge. The external face is convex in both directions, and is smooth and shiny. The root is very large, it is flattened from side to side, and is separated from the crown by a well-developed neck. The root is very firmly imbedded in the deep alveolar cavities. The virgin root contains a large dental pulp-cavity, which, however, becomes obliterated at an early period. When the incisors are worn by the friction of food and the thousand-and-one foreign bodies which the dog "handles" with its mouth, the central tubercle is first used, then the lateral tubercles, and last the whole crown is worn, showing an irregular table of dentine, surrounded by enamel, and having in its centre a dark spot corresponding to the obliterated dental cavity.

The surface of the teeth is of a brilliant white, as, in the dog, they are not covered with cement as in the other animals. The temporary and permanent incisors are alike in form and shape, but the former are very much smaller than the latter, and, as the head and jaw of the young dog are relatively large, the temporary incisors cannot occupy the whole arch, and so have spaces between them showing the gum, while the larger, permanent teeth, when virgin, are just in contact with each other by their free extremities.

TUSKS.

The dog has four tusks, which are very prominent and give the name of *canine teeth* to the corresponding teeth which resemble them in the other animals. They are placed one each side of each jaw, dividing the space between the incisive arch and the arches of the molars, unevenly; the inferior tusks are nearer to the incisive arch, while the superior ones are nearer the molars, and when the jaws are closed the tusks cross each other, coming in contact by the postero-external surface of the inferior tusk and the antero-internal face of the superior tusk. The temporary tusks are smaller, longer, more curved, and more pointed than the permanent ones.

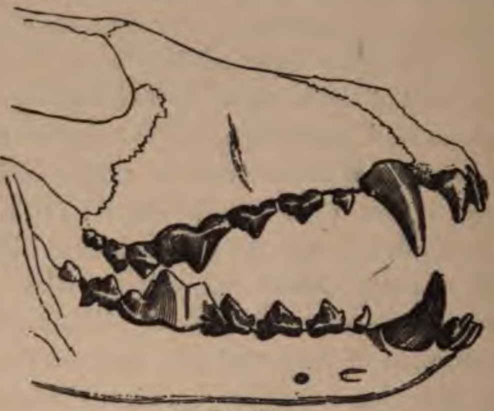


FIG. 176.
Permanent dentition of the dog.

MOLARS.

There are six molars in each arch of the upper jaw and seven in each arch of the lower. They increase in size from the first premolar to the fourth of the upper jaw, and to the first post-molar (fifth of the lower jaw), and then diminish in size at the next to last and last molar. They have large, bulbous crowns with pointed eminences, which serve for the tearing rather than the grinding of food. In the upper jaw the first three premolars are unilobular, the last is bilobular, and the last two post-molars have flat crowns. In the lower jaw the four premolars are unilobular, the first molar has three eminences, and the last two have two.

When the teeth of the dog have accomplished their eruption, they cease to grow and their roots remain firmly fixed in the alveolar cavities. In the first dentition only the premolars are found; the post-molars appear as permanent teeth.

The molars in the dog do not form simple arches as in the other animals, but each arch represents a double curve; so that the two arches on either jaw make the form of a lyre, with its base backward and its apex forward, the widest portion of which is on a line between the last premolar and the first molar. The form or curve of the arches varies considerably with the different races of dogs, and increases greatly in those breeds which, by domestication, have had their heads and maxillæ shortened. These changes may almost approach the nature of a deformity, and the last premolar and first molar may be crowded entirely out of the line of the other teeth, or may be absent, as is sometimes seen in the pug or fancy bull-dogs.

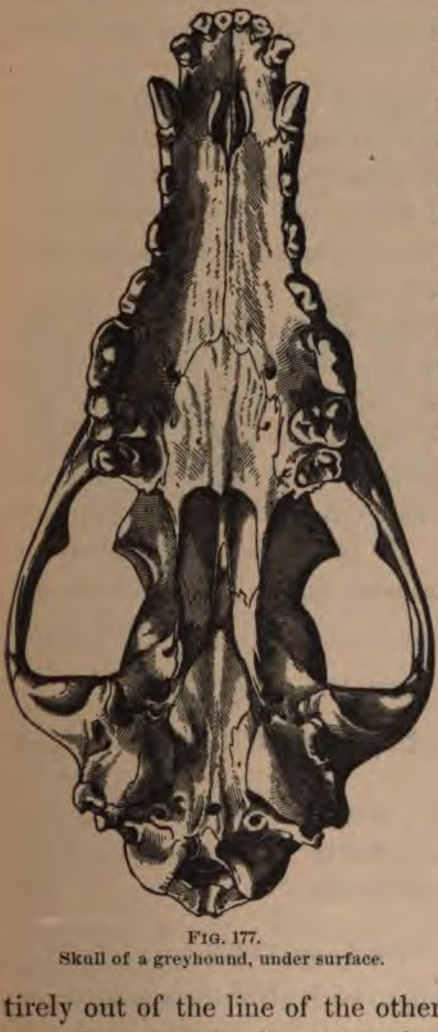


FIG. 177.
Skull of a greyhound, under surface.

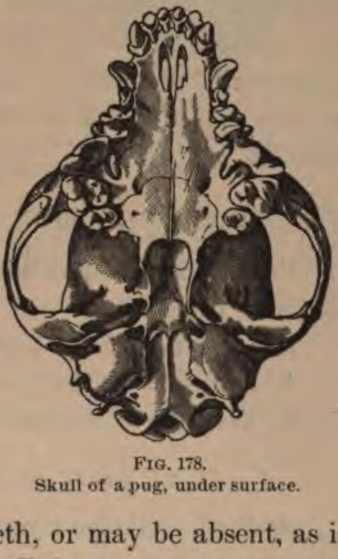


FIG. 178.
Skull of a pug, under surface.

Dr. James A. Waugh informs me that in the Mexican hairless dogs the teeth are generally irregular in number and relative position in the jaws. They have no tubercles or trefoils on the table surface of the incisor teeth. They have no canine teeth, or tushes, in either jaw. He has met with some half-breds that had canine teeth in the upper or the lower jaw, but found no cases with those teeth in both jaws. The molars vary in number and relative position in different animals. The development of the adult dentition is much slower and later than in other classes of dogs.

One Mexican hairless dog, aged 2 years, had five superior incisors, no canine teeth, two superior molars on each side, one large molar and one very small molar behind the large one; two inferior incisors, no canine teeth, two inferior molars on each side, one large molar and one very small molar behind the large one. Total number of teeth, 15.

A Mexican hairless bitch, aged 2 years, had four superior incisors in front and one on right side midway between the front teeth and the molars, no canine teeth, two superior molars on each side, one small molar and one large molar behind the smaller one; seven inferior incisors in front, and two on each side midway between the front teeth and the molars, no canine teeth, two inferior molars on each side, one large molar and one small molar behind the large one. Total number of teeth, 24.

DETERMINATION OF AGE BY THE TEETH.

From the evidences furnished by the teeth the age is divided into three periods:—

1. Eruption of the temporary teeth.
2. Eruption of the permanent teeth.
3. Wearing of the permanent teeth.

ERUPTION OF THE TEMPORARY TEETH.

At Birth.—Puppies may be born with all of their temporary teeth, but if the teeth have not appeared the eruption commences at once by the incisors and tusks of the upper jaw, and the entire dentition is effected within the first three weeks at the longest. (Fig. 179.)

Two to Four Months.—A month before the eruption of the permanent teeth the temporary pinchers and often the intermediate teeth in both jaws become loose and fall out; at this time the points of the permanent teeth can be felt by pressing on the gums. (Fig. 180.)

ERUPTION OF THE PERMANENT TEETH.

The permanent teeth replace those of first dentition several months earlier in the large races of dog than in the terrier varieties. Medium-sized dogs, setters, etc., make the change later than the large dogs and earlier than the terriers.

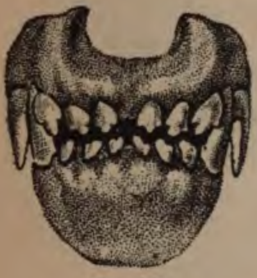


FIG. 179.

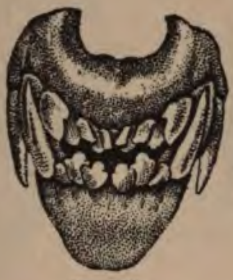


FIG. 180.

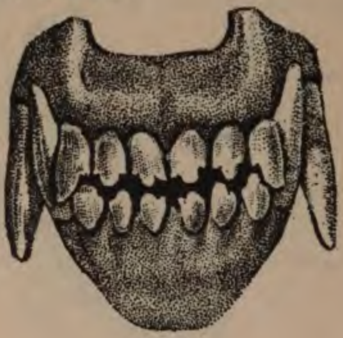


FIG. 181.

FIG. 179.—Teeth of puppy two months old.
FIG. 180.—Teeth of dog four months old; the incisors are loose and ready to fall out.
FIG. 181.—Teeth of dog one year old, showing the incisors and tushes fresh and unworn.

Five to Eight Months.—According to the race of dog, the permanent teeth appear rapidly in the following order: pinchers, intermediate, corners, and tusks. The incisors do not come out obliquely, as in the herbivora. It is worthy of note that, while the herbivora do not have all of their permanent dentition until they have arrived at their full development of body, the carnivora have theirs long before they have attained their growth and before the consolidation of their bones.

One year.—For the first few months after their appearance there is no alteration in the teeth; at one year they are pure white and the tubercles on the incisors are intact. (Fig. 181.)

Fifteen Months.—From fifteen months on, commences the wearing away of the teeth. This is first seen on the inferior pinchers, while the tusks and other teeth remain fresh and white in color.

Eighteen Months to Two Years.—At about this time the tubercles of the inferior pinchers become worn down and those of the other incisors commence to be used. (Fig. 182.)

Two and One-half Years to Three Years.—After two and a half years the tubercles of the inferior intermediate teeth are worn away, the incisors of the upper jaw show signs of use, and all of the teeth commence to lose their fresh, white appearance and become yellowish and discolored. (Fig. 183.)

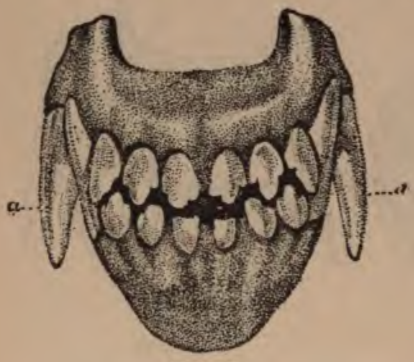


FIG. 182.

Teeth of dog eighteen months old, showing use of the inferior pinchers. The tushes are still fresh and white.

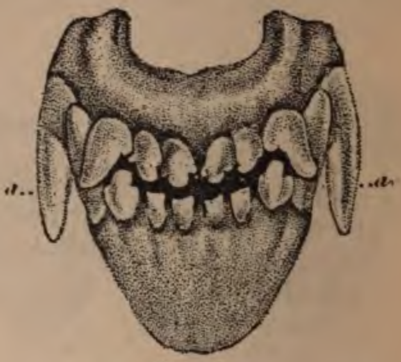


FIG. 183.

Teeth of dog two and a half years old, showing use of inferior pinchers and intermediate teeth.

Three and One-half Years to Four Years.—The pinchers of the upper jaw become worn down and are followed by the wearing of the superior intermediate teeth.

The discoloration of the teeth increases and the tusks become yellow and dirty in appearance.

After this the leveled and broken teeth give no indication of the age. A Great Dane, which for twelve years had only been fed at the table on tid-bits, and a poodle of thirteen years, had teeth as fresh as those of an ordinary dog at four or five; and bull-terriers and others at four or five may have the incisors nearly worn away.

The leveling of the teeth of the dog consists of the wearing away of the middle tubercle to the level of the lateral tubercles and the wearing of the enamel from these. As we have just seen, the leveling commences with the inferior pinchers, is followed by that of the inferior intermediate teeth, and does not commence on the superior incisors until it is complete on the inferior ones; with the superior incisors it commences with the pinchers and follows with the intermediate teeth; the tusks do not commence to wear until the use of the incisors is marked. The leveling of the teeth may, however, take place much more rapidly or more slowly than has been indicated above, and may even be very irregular in the teeth which it first affects, according to the nature of the food upon which the animal is nourished.

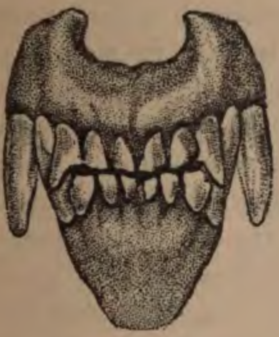


FIG. 184.

Teeth of dog over three years old, showing use of all of the incisors; the tushes are becoming yellow.

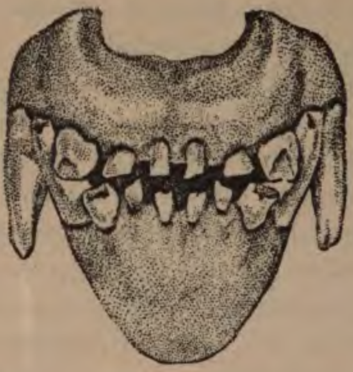


FIG. 185.

Teeth of an old dog; all of the incisors and tushes are much used and worn.

Dogs fed on meat and those which have bones to knaw use their teeth more rapidly than those which are fed on soups, broken bread, and vegetables. Dogs which are pugnacious, and those which are taught to swing on ropes or straps and to fetch objects, such as sticks, stones, etc., use their teeth rapidly and are apt to have their tusks much worn. These dogs also frequently have irregular mouths, from broken teeth. From these causes it sometimes happens, especially with the larger dogs, that the teeth are so altered after three years that no intelligible deduction can be drawn from the appearance of the mouth.

DETERMINATION OF AGE FROM OTHER SIGNS.

The young dog is born with its eyelids closed; these do not open until the ninth or tenth and sometimes as late as the fifteenth day.

Young dogs have heads which are large in proportion to their size, and in which the cranium is large in proportion to the size of the face.

Old dogs become gray around the nose, eyes, and forehead; their noses become larger, and the skin over the whole face becomes wrinkled. The lips become everted and show the red mucous membrane along their irregular borders. The skin, at the ordinary points of pressure in decubitus, especially in large dogs, becomes denuded of hair and develops an epithelial growth which is almost horny in character; so that in old dogs we find callous points at the elbow, hock, salient points of the pelvis, and sometimes on the shoulder. They are apt to develop eczema and other skin troubles of a chronic nature. Frequent epithelial tumors appear over the surface of the body. In the old male growths on the penis and in the old female tumors in the mammary glands are not rare. Deafness, without apparent lesion in the ears, and cataracts, with a congested condition of the conjunctiva, occur. Paralysis of the hind-legs, from no evident cause, may end the old dog's life.

AGE OF MAN.

The age of man has always been a subject of the most profound philosophical study; for, from the time of the philosopher's stone to the researches in alchemy of the Middle Ages for the source of life everlasting, and to the elixirs of life of the quack medicines of to-day, it has always been the desire of a large number of mankind to outlive its time. From a practical point of view, the question of the age of man is one of sentiment. The periods of *babyhood*, *youth*, *adult* life, and *old age* are definitely marked, and depend not altogether upon the number of years which the animal has lived, but to a greater degree upon the mental development, which, in a precocious youth, makes a man of him, and in an adult, who should have been in his prime, but has abused his natural surroundings, makes prematurely an old man.

The mother, as a matter of sentiment, looks to the dentition of her baby for an evidence of its development, and the teeth furnish medico-legal proof of the age of certain subjects; so that the dentition of man, as in the other animals, is of first importance as an indication of age, during a certain period, until adult life.

DENTITION OF MAN.

$$\text{Dental formula}\begin{cases}\text{Temporary}, \quad . \quad . \quad . \quad . \quad \dfrac{2\,.\,1\,.\,2}{2\,.\,1\,.\,2}=20\\[2ex] \text{Permanent}, \quad . \quad . \quad . \quad \dfrac{2\,.\,1\,.\,2\,.\,3}{2\,.\,1\,.\,2\,.\,3}=32\end{cases}$$

Man has thirty-two teeth,—four incisors in each jaw (8), two tushes in each jaw (4), and five molars (which are subdivided into two premolars and three molars) in each arch of both jaws (20). The arch of the teeth, unlike in the other animals, is continuous, no interspace existing between the incisors and the tushes, nor between the latter and the molars.

The upper arch is slightly larger than the lower, and the corresponding teeth of each jaw are not directly opposite each other, but come in contact with two opposite teeth, so that, if one is lost, the opposing tooth still finds a resisting surface, and has not the tendency to displacement found in the herbivora under similar circumstances.

The incisors, four in each jaw, are known as the *central* and *lateral* incisors; they have a single root and a sharp, wedge-shaped crown, divided from the former by a distinct neck.

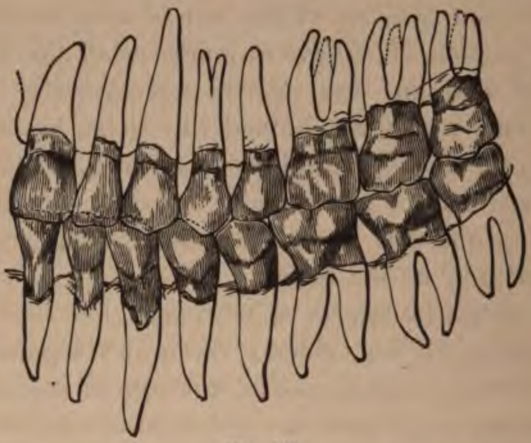


FIG. 186.
Upper and lower teeth of one-half of the dental arches in each jaw; two incisors, one tush, two premolars, three molars, in each.

The tushes, called *cuspids* (*cuspis*, a spear), from their pointed crowns, are two in number in each jaw. These teeth are also called *canine* teeth; those of the upper jaw are called *eye* teeth, and those of the lower jaw *stomach* teeth.

The premolars, two in each side of jaw, are called *bicuspids* (*bicuspidati*, two spear-points), from the two eminences on their crowns.

The molars, six in each jaw, are known as the *first*, *second*, and *third*, or as the *six-year* molars, *twelve-year* molars, and the *wisdom* teeth (*dens sapientia*), from the fact that the two first appear at six and twelve years, and the last not until adult age, when wisdom is supposed to come.

The incisors are double wedge-shape,—widest at the cutting edge, thickest at the neck, slightly concave on the inner and slightly convex on the outer surface. The superior or upper are larger than the inferior or lower incisors, and the central incisors are wider than the lateral. In the case of the inferior incisors, the laterals are wider than the centrals. The incisors, both superior and inferior, have each but one root. The use of these teeth in eating is to "bite" or cut off a portion of food, operating on the same principle as a pair of scissors. The cuspids are less concave on the inner surface and more convex on the outer surface than the incisors, and terminate in a point. They have but one root, but this is longer and stronger than that of any other tooth in the mouth. The superior cuspids are larger and have longer roots than the inferior. The use of the cuspids is to seize and tear or lacerate obstinate substances preparatory to mastication. It is an interesting fact that these teeth are more prominent in proportion as the animal approaches the purely carnivorous or flesh-eating class, and are never found in an animal having horns. The bicuspids are smaller than the cuspids, convex on both outer and inner surfaces, and flattened on the sides. Their long diameter is across the jaw. The roots are conical. The inferior have but one root; the superior sometimes a single root, often deeply grooved, and sometimes entirely divided,—bifid. The molars have large grinding surfaces, divided by grooves into cusps or points. The crowns of the inferior are larger than those of the superior. In each jaw they decrease in size from before backward. The superior first and second molars have, as a rule, three roots each. The inferior first and second molars have each two roots, which are often deeply grooved, and sometimes bifid. The third molars or wisdom-teeth of both jaws have but a single root each, though this is sometimes divided into three in the upper jaw and two in the lower. The inferior third molar is larger than the superior.

The deciduous or temporary teeth are much smaller than the permanent, although the roots are generally larger and longer, in proportion to the size of the crowns, than those of the adult set. There are only twenty teeth in the deciduous set,—four incisors, two cuspids, and four molars in each jaw. Figs. 190 and 191 represent the temporary teeth,—superior and inferior. There are no bicuspids and no third molars or wisdom-teeth in the temporary set. Four bicuspids and two wisdom-teeth in each jaw,—twelve in all,—which are not in the deciduous or temporary set, make the permanent set to consist of thirty-two teeth.

The surfaces of the teeth which are toward the lips are called "labial;" toward the cheeks, "buccal;" toward the tongue, on the lower jaw, "lingual;" and toward the roof of the mouth, on the upper jaw, "palatal." The surfaces next to each other are called "approximal;" those looking toward the centre, "mesial;" and those looking from the centre, "distal." The parts of the six front teeth of both jaws which come in contact with each other are called the "cutting edges," and the broad surfaces of the bicuspids and molars which are brought in contact in the act of masticating are called the "grinding or articulating surfaces."

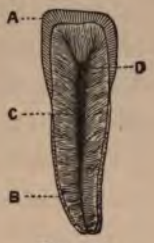


FIG. 187.

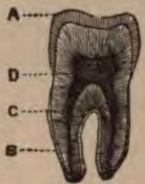


FIG. 188.

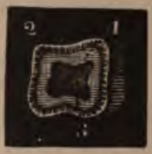


FIG. 189.

The structure of the teeth is approximately that of the tush-tooth of the horse or of the molars of the dog, consisting of a central pulp covered with dentine, which makes up the bulk of the tooth, and which is again covered with enamel. The cement in man covers the *root only*, or at most only slightly overlaps the enamel.

Figs. 187 and 188 represent a central incisor and a molar, split vertically so as to show their various parts. A is the cutting edge or grinding surface, covered, as is the entire crown, with enamel; B, the cementum covering the roots; C, the dentine; D, the pulp-cavity. Fig. 189 shows a transverse section of a molar, of natural size, in which 1 is the dentine; 2, the enamel; 3, the pulp-cavity.

The pulp is *not* replaced by dentine as the animal becomes adult, but remains vascular and with a nerve-supply, and when exposed by disease of the tooth causes the toothache, which is not possible in the adult herbivora.

DETERMINATION OF AGE BY THE TEETH.

TEMPORARY DENTITION.

The baby is born without teeth and depends entirely upon the mother's milk or artificially prepared food which does not require mastication until the fifth month, when the eruption, called *cutting teeth*, so well known in every household, commences with the central incisors. The lower teeth of each set usually precede the upper by several weeks to two or three months.

The teeth usually appear in pairs, but often that of one side precedes the other by some weeks, and in rare cases several pairs may appear at once. The eruption of the teeth in the baby is frequently attended with much pain, and sometimes by grave and serious disturbance of the digestive and nervous systems, terminating even in death. These complications are rare in other animals, but occasionally occur in young dogs, which may have gastro-enteritis or convulsions during the eruption of the permanent teeth, and we have already noted a case of convulsions in a two-year-old colt. An intercurrent disease during dentition may delay or alter its processes.

An increased flow of saliva, hot and dry skin, constipation and diarrhœa, eruptions of the skin and ulcers in the mouth are frequent attendant symptoms of the appearance of the teeth. Difficult dentition is accompanied by itching of the nose, twitching of the muscles, dilatation of the pupils, and evidences of suffering and fever.

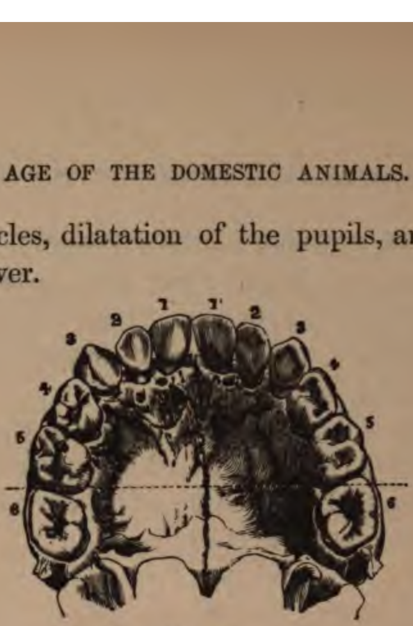


FIG. 190.
Dentition of child six years old, upper jaw.

The eruption of the temporary teeth is shown in the following table:—

Two central incisors (No. 1) between the fifth and eighth months.
Two lateral incisors (No. 2) between the seventh and tenth months.
Two canines (No. 3) between the twelfth and sixteenth months.
Two first molars (No. 4) between the fourteenth and twentieth months.
Two second molars (No. 5) between the twentieth and thirty-sixth months.

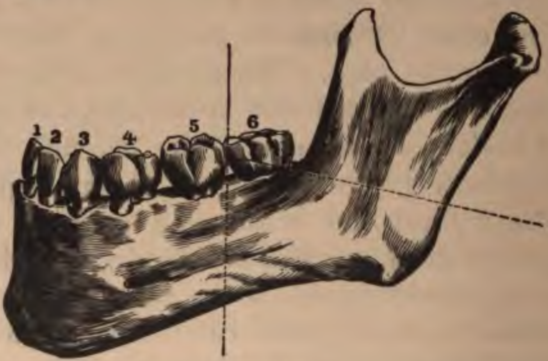


FIG. 191.
Dentition of child six years old, lower jaw.

The teeth marked "6," in Figs. 190 and 191, do not belong to the temporary set.

PERMANENT DENTITION.

The permanent teeth are well developed and pressing on the roots of the temporary ones before the latter are shed.

Fig. 192 illustrates the jaws of a child about six years of age, in which the relations of the two sets of teeth are shown,—the temporary teeth still in position, and the sixth-year molars just erupting. The permanent incisors, both upper and lower, —which, after the sixth-year molars, are the next to erupt,—are the most advanced, both as to completeness of form and as to position. The canines, which are not due until the child is between eleven and thirteen years of age, are not nearly so complete in form nor so far advanced toward eruption.

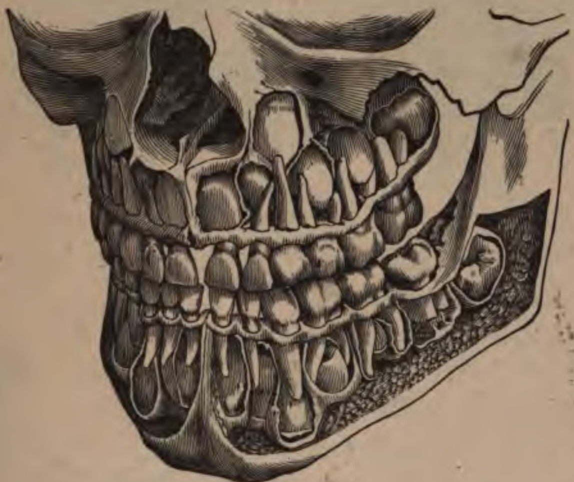


FIG. 192.

The permanent teeth appear in the following order:—

First molars,	5 to 6 years.
Central incisors,	6 to 8 years.
Lateral incisors,	7 to 9 years.
First bicuspids,	9 to 10 years.
Second bicuspids,	10 to 11 years.
Canines,	11 to 13 years.
Second molars,	12 to 14 years.
Wisdom-teeth,	17 to 21 years.

Fig. 193 illustrates an upper permanent or adult set of teeth. These teeth are known by the same names as the corresponding teeth of the lower jaw.

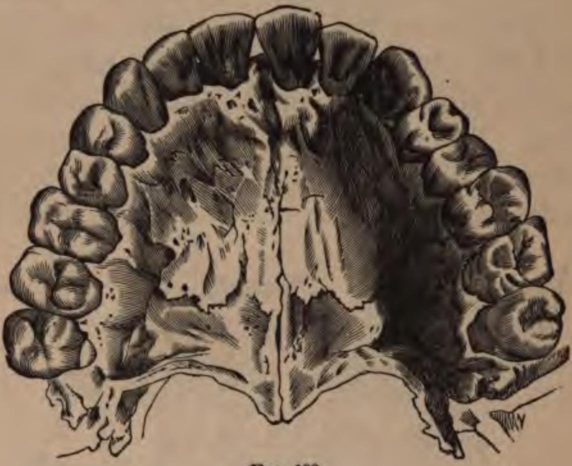


FIG. 193.

Fig. 194 is a side view of the adult lower jaw, in which No. 1 represents the central incisor; No. 2, the lateral incisor; No. 3, the canine; No. 4, the first bicuspid; No. 5, the second bicuspid; No. 6, the first (sixth-year) molar; No. 7, the second (twelfth-year) molar; and No. 8, the third molar, or wisdom-tooth

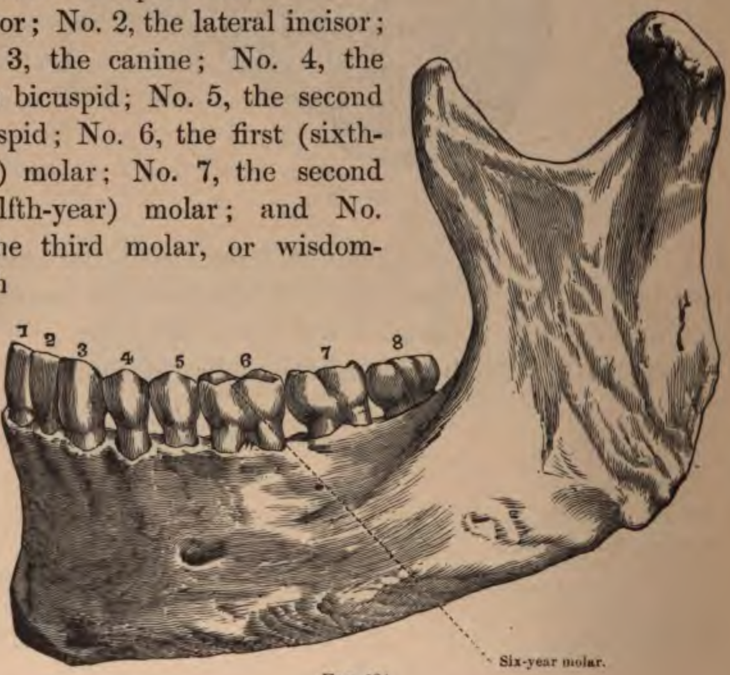


FIG. 194.

BIBLIOGRAPHY.

Goubaux and Barrier.—De l'Exterieur du cheval. Par MM. Armand Goubaux et Gustave Barrier, deuxiéme edition. Paris: Asselin et Houzeau, 1890.

Chauveau.—Traité d'Anatomie comparée des Animaux Domestiques. Par A. Chauveau. 3me edition, de S. Arloing, Paris. J. B. Baillière et Fils, 1879.

Girard.—Traité de l'Age du Cheval. Par feu N.-F. Girard. 3me edition, etc., augmentée de l'age du boeuf, du mouton, du chien, et du cochon, par F. Girard. Paris: Bechat Jeune.

Bracy Clark.—On the Knowledge of the Age of the Horse by his Teeth. London, 1826.

Mayhew.—The Horse's Mouth, etc. By Edward Mayhew.

H. Bouley. Ages. Nouveau Dictionnaire pratique de Médecine de chirurgie et d'hygiene vétérinaires. Paris, 1856.

Reynal.—Age. *Ibid.*

Simonds.—The Age of the Ox, Sheep, and Pig, etc. By James Beart Simonds. London, 1854.

Olof Schwartzkopff.—Modern Feeding of Pigs, and its Influence upon the Formation of the Skull and Dentition.

J. W. White, M.D., D.D.S.—The Mouth and the Teeth. P. Blakiston, Son, & Co., Philadelphia, 1891.

G. Cuvier.—Leçons d'anatomie comparée.

Toussaint.—De l'age des chevaux de course, au point de vue de la doctrine de la precocité. Recueil de Méd. Vét., 1875, fol. 992.

——Traité de la connoissance exterieure de cheval, avec un examen analytique de toutes les fourberies des Maquignons. Turin, 1769.

F. Locoq.—Traité de l'Exterieur du Cheval et des principaux animaux domestiques. 5me edition. P. Asselin, Paris, 1876.

André Sanson.—Traité de Zootechnie. Paris, 1874.

A. Railliet.—Eléments de Zoölogie Médicale et Agricole. Paris, 1886.

Carlo Ruini.—Anatomia del Cavallo, Gasparo Bindoni. Venitia, MDXCIX.

Francesco Liberati Romano.—La perfettione del Cavallo. Roma, 1639.

Pessina.—Sul modo de conoscere dai denti l'età dei Cavalli. Milan, 1831.

Carlo Lessona.—Compendio d'Ippiatria. Torino, 1846.

Youatt.—History, Treatment, and Diseases of the Horse.

W. H. Clarke.—Horse's Teeth. Turf, Field, and Farm. New York, 1883.

Liautard.—How to tell the Age of the Domestic Animals. Jenkins, New York.

Ellenberger and Baum.—Anatomie des Hundes. By Dr. W. Ellenberger and Dr. H. Baum. Paul Parey, Berlin, 1891.

Ch. Cornevin.—Traité de Zootechnie Générale. J. B. Baillière et Fils. Paris, 1891.

Cornevin et Lesbre.—Charactères ostéologiques différentiels de la chévre et du mouton. Journal de Méd. Vét. et de Zootechnie, September, 1891.

Cruzel.

Daubenton.—Histoire Naturelle, etc.

Erick-Viborg.

James A. Waugh.

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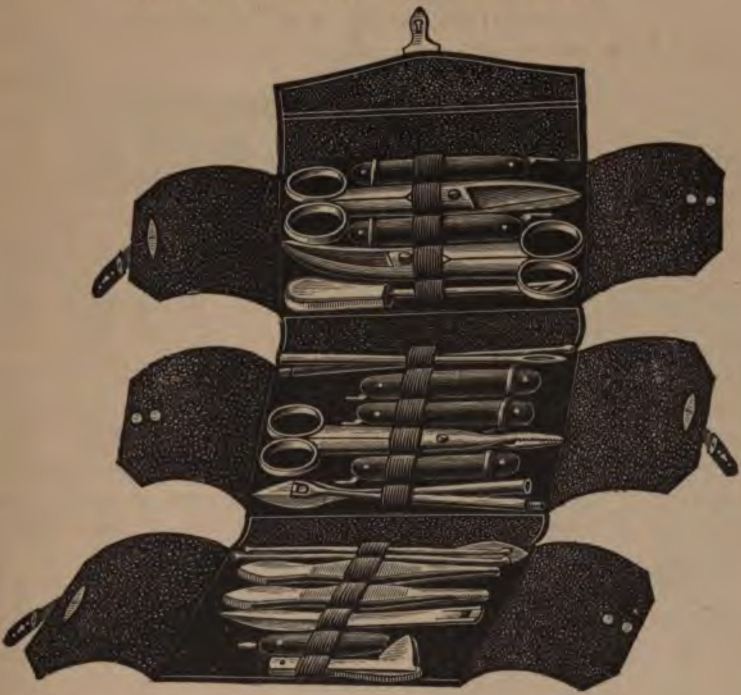

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